OMB No. 2040-0042 Approval Expires 11/30/2014

United States Environmental Protection Agency

Underground Injection Control Permit Application

(Collected under the authority of the Safe Drinking Water Act. Sections 1421, 1422, 40 CFR 144)

I. EPA ID Number			
		T/A	C
U			

Read Attached Instructions Before Starting

For Official Use Only

Application approved mo day year	Date received mo day year	Permit Number	Well ID	FINDS Number

II. Owner Name and Address

Owner Name: Pacific Gas and Electric Company

Street Address: 77 Beale Street

Phone Number: (415) 973-6270

City: San Francisco

State: CA

ZIP CODE: 94105

III. Operator Name and Address

Owner Name: Pacific Gas and Electric Company

Street Address: 77 Beale Street

Phone Number: (415) 973-6270

City: San Francisco

State: CA

ZIP CODE: 94105

IV. Commercial Facility

- [ ] Yes
- [x] No

V. Ownership

- [x] Private
- [ ] Federal
- [ ] Other

VI. Legal Contact

- [x] Owner
- [ ] Operator

VII. SIC Codes

4911, 4923, 4931, 4932,

VIII. Well Status *(Mark "x")*

- [ ] A. Operating — Date Started mo day year:
- [ ] B. Modification/Conversion
- [x] C. Proposed

IX. Type of Permit Requested *(Mark "x" and specify if required)*

- [x] A. Individual
- [ ] B. Area

Number of Existing Wells	Number of Proposed Wells	Name(s) of field(s) or project(s)
0	1	King Island

X. Class and Type of Well *(see reverse)*

A. Class(es) (enter code(s))	B. Type(s) (enter code(s))	C. If class is "other" or type is code 'x,' explain	D. Number of wells per type (if area permit)
V	X	This is an air injection/withdrawal test well for temporary use during a feasibility study of Compressed Air Energy Storage	1

XI. Location of Well(s) or Approximate Center of Field or Project

Latitude Deg	Min	Sec	Longitude Deg	Min	Sec	Township and Range Sec	Twp	Range	1/4 Sec	Feet From	Line	Feet From	Line
38	4	57.61	121	25	17.23								

XII. Indian Lands (Mark 'x')

- [ ] Yes
- [x] No

XIII. Attachments

(Complete the following questions on a separate sheet(s) and number accordingly; see instructions)

For Classes I, II, III, (and other classes) complete and submit on a separate sheet(s) Attachments A--U (pp 2-6) as appropriate. Attach maps where required. List attachments by letter which are applicable and are included with your application.

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

A. Name and Title *(Type or Print)*	B. Phone No. *(Area Code and No.)*
Michael Medeiros, Manager, Renewable Energy Development	(415) 973-6270
C. Signature: M Medeiros	D. Date Signed: 5-13-14

EPA Form 7520-6 (Rev. 12-11)

Underground Injection Control Permit Application Technical Attachments

PG&E Compressed Air Energy Storage Project
Compression Testing Program
King Island Gas Field, San Joaquin County, California

Revised April 18, 2014



CERTIFICATION

This report has been prepared under the review and supervision of Michael Tietze, C.E.G, as an employee of Jacobson James & Associates, and with expertise in engineering geology and deep well hydrology. The report has been prepared with the assistance of Mark Ausburn, P.G., as an employee of WorleyParsons and with expertise in petroleum geology; Saeed Irani, P.E., as an employee of Irani Engineering and with expertise in petroleum engineering and injection well drilling and design; and Alan Burzlaff, P.E., as an employee of MHA Petroleum Consultants and with expertise in petroleum engineering and reservoir engineering. Their signatures and stamps appear below. The findings, recommendations, specifications and/or professional opinions presented herein have been prepared in accordance with generally accepted professional geologic and engineering practice for similar projects, and within the scope of the project. There is no other warrantee, either express or implied.

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1.0 INTRODUCTION

This report presents technical attachments to an Underground Injection Control (UIC) permit application for the installation and operation of a test Injection/Withdrawal Well associated with the Pacific Gas and Electric Company (PG&E) Compressed Air Energy Storage (CAES) feasibility study project. The project site is located at the King Island Gas Field in rural northwestern San Joaquin County, approximately 2.5 miles west of the City of Lodi, as shown on Figure 1. This report introduces the project background, setting and schedule, and includes the technical attachments required for a UIC permit application under 40 CFR Parts 144-146.

The proposed Injection/Withdrawal Well will be used to inject oxygen-depleted air (< 5% oxygen, consisting mostly of nitrogen)[1] into a depleted natural gas reservoir to build an air bubble as part of a "Compression Test." During and after the building of the air bubble, a series of injection, shut in, and flow tests will be conducted to investigate the reservoir's performance for a CAES application.

A permit application and supporting attachments were previously submitted for the proposed project on May 3, 2013, with updates on June 21 and July 18, 2013. This revised permit application, report and attachments address comments received from EPA regarding the original permit application package, and describe changes made to the project that decrease the potential risk to Underground Sources of Drinking Water (USDW). The primary changes incorporated in this submittal include:

- Utilizing oxygen-depleted air for building the air bubble;
- Decreasing the amount of injected air by approximately half, which significantly reduces the maximum pressure requirements to complete the test;
- Decreasing the maximum injection rate by approximately 20 percent and the injection rate during testing by 40 percent;
- Decreasing the requested maximum injection pressure by 500 pounds per square inch (psi);
- Shortening the duration of the test, which, together with decreasing the bubble volume and maximum injection pressure, will decrease the amount of time that subsurface pressures are increased above the normal hydrostatic gradient;
- Incorporating various additional monitoring and testing procedures to decrease risk to USDW in response to EPA comments;
- Using the widely accepted MODFLOW and THWELLS modeling codes to evaluate pressure buildup within and near the gas reservoir;[2] and

[1]The physical properties of oxygen depleted air are not significantly different from those of air for the purposes of the proposed Compression Test.

[2] A fully compositional Eclipse reservoir model has also been constructed to support the data objectives of the CAES study; however, it does not extend beyond the reservoir boundaries and is not as readily adaptable for the purpose of evaluating pressure buildup in

- Updating the reservoir characterization with data collected since the previous submittals.

The proposed well to test developing CAES technology will be classified as a Class V Injection Well under the UIC regulations. In a guidance document dated March 1, 2007 regarding the application of the UIC permitting process to Class V wells to be utilized for carbon sequestration pilot projects, the Director of EPA's Office of Groundwater and Drinking Water stated:[3]

> *"Class V experimental technology wells are intended to demonstrate unproven but promising technologies. EPA's rationale for allowing the use of Class V experimental technology wells is to encourage innovation. In other words, under EPA's regulations an injection well that is being used to demonstrate a developing technology may be subject to more flexible, yet fully protective, technical standards than those designed for commercially operating facilities."*

The proposed CAES feasibility study has been funded by the United States Department of Energy because it is intended to investigate a similar promising technology with potential benefits to decrease greenhouse gas emissions and promote energy independence. Based on this understanding, and the fact that appropriate standards for Class V wells are established on a case-by-case basis, we have applied the requirements for permitting a Class I non-hazardous wastewater injection well where applicable. However, because this test injection program will involve a pressure buildup in the injection zone that is expected to be limited in magnitude and duration (due to the short 90 day duration of the compression test and highly permeable reservoir), and the medium that is being injected is air[1] (rather than waste water), some of the typical Class I well requirements appear to be unwarranted and un-necessary to protect USDW. In such instances, especially where typical Class I requirements threaten the feasibility of implementing the proposed compression test, we have proposed alternatives from the Class I requirements and provided supporting rationale for these deviations.

This report and the supporting attachments have been prepared by Jacobson James & Associates (JJ&A) under subcontract to WorleyParsons Group. Assistance in preparing the technical attachments hereto was provided by WorleyParsons Group (engineering design of surface facilities by Annette Zimmerman, P.E. and Fred Sanchez, P.E. and geologic interpretation by Frank Cressy P.G. and Mark Ausburn P.G.), MHA Petroleum Consultants (reservoir engineering and Area of Review determination by Alan Burzlaff, P.E. and Tim Hower, P.E.) and Irani Engineering (well evaluation, well design, plugging and abandonment by Saeed Irani, P.E.). In addition, under contract to PG&E, technical review was provided by Charlie Stinson, P.E. and James Fairchild, P.E., and consultation regarding reservoir geology was provided by Douglas Imperato, Ph.D.; and under contract to MHA Petroleum Consultants, consultation regarding reservoir structural interpretation from 3D seismic reflection data was provided by Tom Fassio, P.G. This project was funded, in part, by DOE contractDE-OE0000198.

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support of a UIC permit application. Therefore, methods that utilize the THWELLS and MODFLOW modeling codes have been adopted as described in Attachments A and C.

[3] United States Environmental Protection Agency, 2007. Memorandum from Cynthia C. Dougherty, Director, Office of Groundwater and Drinking Water, to Water Management Division Directors, Regions I through X. Subject: Using the Class V Experimental Well Classification for Pilot Geological Sequestration Projects – UIC Program Guidance (UICPG #83). March 1.

1.1 FACILITY INFORMATION

An Underground Injection Control Permit Application is being submitted for the following Facility.

Facility Name:	PG&E Compressed Air Energy Storage Project Injection/Withdrawal Test Well
Facility Location:	King Island, San Joaquin County, California Latitude: 38.081992; Longitude: -121.422161 (NAD 83) X=1734880.641 Y= 577346.753 (NAD 27, Zone III) Township 3 North, Range 5 E, Section 27, Northwest ¼
Contact Information:	Mike Medeiros Manager, Renewable Energy Development Pacific Gas and Electric Company 77 Beale Street San Francisco, CA 94105 (415) 973-6270

1.2 PROJECT BACKGROUND

Renewable energy resources, such as wind and solar power, have the potential to reduce dependence on fossil fuels and greenhouse gas emissions in the electric sector, and are a fundamental part of the United States Federal strategy to address climate change and energy independence. Concerns regarding climate change have also spurred state regulation encouraging the integration of renewable resources into the power generating fleet. For example, under California's existing Renewable Portfolio Standard, utilities must supply 33 percent of all electricity retail sales from eligible renewable resources by the year 2020. Much of this new generation is expected to be derived from the addition of new solar and wind power generation[4]. However, because wind and solar resources are by nature intermittent (*i.e.*, the sun does not always shine and wind does not always blow when power is actually needed), their addition to the power generating fleet poses challenges to the reliable operation of the power distribution grid and the cost of their integration. As such, energy storage has been identified as an essential component of strategies to mitigate these effects and facilitate greater penetration of wind and solar power into the existing power generation and distribution system. CAES has been identified as a key enabling technology for expanding reliance on renewable resources for electricity production[5].

The United States Department of Energy (DOE), the California Public Utilities Commission (CPUC), and the California Energy Commission (CEC) have funded PG&E to investigate the viability of using a

[4] California ISO, 2010, Integration of Renewable Resources, Operational Requirements and Generation Fleet Capability at 20% RPS, August 31.
[5] Denholm, Paul, E. Ela, B. Kirby, and M. Milligan, 2010, The Role of Energy Storage with Renewable Power Generation, NREL Technical Report NREL/TP-6A2-47187, January.

depleted natural gas field to store energy by injecting compressed air into a subsurface reservoir, including periods of excess generation when renewable energy is available, and recovering it by generating electricity using turbo-generation equipment during peak demand periods. The application of CAES using a depleted gas reservoir for storage is of significant interest to DOE, the CPUC and the CEC because it provides several distinct advantages. First, depleted gas reservoirs are proven geologic traps that formerly held natural gas reserves for millions of years, and are therefore capable of containing compressed air to power a CAES facility. Secondly, the subsurface data typically available for natural gas fields, including well logs, production data and seismic imaging data, are useful for characterization of the reservoir and predicting its performance in a CAES application. Finally, the Sacramento and San Joaquin Valley Natural Gas Provinces contain many natural gas fields that are situated along California's power transmission backbone, and thus situated to provide utility-scale power storage to facilitate integration and distribution of renewable energy throughout the state. Similar situations exist elsewhere in the United States.

1.3 PROJECT OVERVIEW

The proposed project consists of a feasibility-level investigation into the design, performance and reliability considerations associated with using a depleted natural gas reservoir for air storage in a CAES application. The results of the project will help to develop best practices and accelerate the market-readiness of the technology in the United States. For the purposes of this UIC application, it is important to note that the project does not include construction of a permanent CAES facility, or a full-scale or long-term air injection and recovery well; rather, the project is a short term, scaled test to assess the properties of a storage reservoir and evaluate the implications of the results. As described further below, the actual duration of the test will be approximately 90 days or less, and the amount of air injected will be only a small percentage of the original gas that was in place in the gas reservoir prior to production, or of what is needed for a full-scale CAES facility.

The first phase of the project involved screening of depleted gas reservoirs throughout Northern California to select a subset of fields with the most favorable characteristics for further evaluation. Three reservoirs were selected for computer modeling to further assess their suitability to support a CAES plant, and two of these were selected for drilling core wells to investigate reservoir and cap rock characteristics through well logging and laboratory analysis of core samples. Based on this work, the King Island Gas Field has emerged as the preferred location to perform reservoir pressure testing during a second, "Compression Test," phase of the project. This second phase includes installation and use of the Injection/Withdrawal Well that is the subject of the enclosed UIC permit application. Installation of this well is targeted to commence in June 2014 and the compression test will last for approximately 90 days starting in July/August 2014.

To conduct the Compression Test, a test well will be drilled into the King Island Gas Field and used to inject compressed oxygen-depleted air[6] to create a "bubble" within the boundaries of the original gas pool. The work will include expansion of an existing drilling pad and improvement of access roads as needed, drilling of an injection/withdrawal well, converting two existing nearby gas wells into monitoring wells, installation of an electrical power supply and distribution system, and temporary mobilization of air compression equipment and other equipment needed to perform the test. During the approximately 90-day test, the Injection/Withdrawal Well will be used to perform a series of injection, withdrawal and pressure fall-off and build-up tests while monitoring the Injection/Withdrawal Well and the monitoring wells. After completion of the test, a monitoring period will follow for a period of approximately six to nine months to evaluate post-test pressure declines. After the monitoring period, a decision will be made to either shut the well in and place it in inactive status or plug and abandon the well.

The data collected during the Compression Test will aid in the assessment of reservoir performance on a pilot scale. The data from the test will be used to refine the computer model of the reservoir and develop a conceptual design for full scale reservoir development to support a CAES plant, and to support subsequent engineering, economic and environmental evaluations and conclude the project feasibility analysis. The feasibility analysis work and reporting must be concluded prior to September 2015 to qualify for funding under the DOE grant; therefore, completion of the prerequisite Compression Test by the end of 2014 is considered critical to the successful completion of the project.

[6] Based on the results of testing with oxygen-depleted air, a short test involving the injection of ambient air may be conducted if certain decision criteria are met, including stringent safety criteria. The total duration of the test is not expected to exceed approximately 90 days.

2.0 PROJECT DESCRIPTION

This section provides a summary description of the Compression Test to provide context for the UIC permit application for the project. Details regarding the compression test and Injection/Withdrawal Well construction are presented in the attachments to this report.

2.1 SITE DESCRIPTION

The test site encompasses approximately 3 acres of what is currently an irrigated orchard of young walnut trees on ranch property operated by Morada Produce Company. A topographic base showing the locations of the proposed I/W Well, proposed compression facilities, nearby gas wells, water features and principal land uses and development is presented as Figure 2.[7] The ranch is located in the King Island area of the San Joaquin Delta and bounded by White Slough to the north (approximately 1,000 feet from the test site), White Slough and Honker Cut to the west and southwest (approximately 1 to 2 miles from the test site), Bishop Cut to the east (approximately 1,500 feet from the test site), and 8 Mile Road to the south (approximately 1.5 mile from the test site). The area surrounding the test site is generally level and ranges in elevation from approximately 5 to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees topped by paved and unpaved roads. The area surrounding the test site is crossed by a series of gravel ranch roads that provide access to the various ranch fields and to the test site. A ranch yard and a series of ranch houses are located approximately ½ to ¾ mile south of the test site along the south side of an east-west trending gravel road (Figure 2).

The ranch is irrigated using surface water from White Slough and Bishop Cut that is diverted using a series of diversion syphons that discharge water to a system of unlined irrigation canals. Three shallow domestic water wells are located at a cluster of ranch residences located approximately 3,000 feet southeast of the test site. All of the ranch residences are supplied with water from these three domestic water wells. The completion detail of these wells were not available at the time of this permit application; however, it is likely, based on knowledge of other domestic wells in the area and the reported depth to the base of fresh water, that these wells are less than 200 feet deep. No irrigation wells are known to be located within 1 mile of the ranch. The walnut orchard is irrigated using a recently installed drip irrigation system. In the walnut orchard, groundwater levels are maintained at a depth of approximately 6 to 8 feet below ground level by a system of tile drains.

The area surrounding the test site is zoned AG-40, which is an agricultural designation. The White Slough Water Pollution Control Facility (WSWPCF), a wastewater treatment plant operated by the City of Lodi, is located approximately 2 miles east of the test site, adjacent to the Northern California Power

[7] The proposed compression facility will compress and inject air, and does not include intake structures, discharge structures, or hazardous waste treatment storage and disposal facilities. A conceptual process flow diagram and general arrangement of the proposed compression facility is presented as Figures K-1 and K-2, respectively.

Authority (NCPA) Lodi Power Plant. The incorporated City Limits of Stockton are located approximately 3 miles southeast of the site, near the intersection of 8-Mile Road and Interstate Highway 5.

PG&E has entered into agreements with the land owners and mineral rights owners of the properties for rights to perform the compression testing work. Contact information for all land owners within ¼ mile of the proposed boundaries of the compression facility and I/W well is listed below:

- Ashley Lane LLC
  PO Box 659
  Linden, CA 95236-0659
- Cy Oggins
  Chief, Environmental Planning and Management Division
  California State Lands Commission
  100 Howe Avenue, Suite 100 South
  Sacramento CA 95825

2.2 DESCRIPTION OF THE TARGET INJECTION ZONE AND WELL

During the Compression Test, air will be injected into permeable sands of the Upper Cretaceous Mokelumne River Formation (described in Attachments F and G) that occur at elevations between approximately -4,675 feet and -4,800 feet subsea. These sands comprise the depleted (water invaded) King Island gas reservoir, which occurs at the top of an elliptical-shaped erosional remnant of upper Mokelumne River Formation, approximately 230 acres in plan view, that is enclosed on all sides by shale of the Paleocene Meganos Channel fill, and capped by the Eocene Capay Shale (Figure 2, Attachment F). The reservoir sands consist of sandstones with a net composite thickness ranging from about 80 to 220 feet in the uppermost Mokelumne River Formation. Approximately the upper 50 to 120 feet of these reservoir sands were gas filled above an original gas-water contact at an elevation of approximately -4,783 subsea. These deposits are underlain by sands, shales and siltstones and dip slightly to the west. Beneath the shale and siltstone that defines the base of the gas reservoir sands, interbedded sand, mudstone and shale of the Mokelumne River Formation extend for an additional depth of over 1,000 feet and grade vertically downward into the H&T Shale. The sands of the Mokelumne River Formation within the erosional remnant, including those within as well as those underlying the water-invaded gas reservoir, may experience increased pressures as a result of the proposed air injection.

The proposed Injection/Withdrawal Well will be drilled into the northeastern lobe of the gas reservoir near the existing Piacentine 1-27 gas well and the Piacentine 2-27 core well, which was drilled in March 2013, as shown on Figure 2. The Injection/Withdrawal Well will be completed in approximately the upper 40 feet of the water-invaded reservoir sands. Laboratory testing of core samples collected during drilling of the Piacentine 2-27 well earlier this year indicate an average reservoir sand permeability of approximately 800 millidarcys (mD). Pressure buildup within the gas reservoir portion of the Mokelumne River Formation will be controlled by the air injection rate and volume, the geometry and permeability of the reservoir, the compressibility of the air and residual natural gas, and the slow outflow of water through the mudstone and shale that form the base of the reservoir sands. Pressure

propagation through the underlying Mokelumne River Formation will be controlled by the permeability of the sands and interbedded lower permeability mudstone and shale, and the existence and geometry of impermeable boundaries along the flanks and base of the King Island erosional remnant.

The estimated original gas in place, based on gas field production data and reservoir modeling, is approximately 13.8 billion standard cubic feet (Bscf). Approximately 10.5 Bscf of gas were produced from the reservoir, primarily from two wells, between 1985 and 2003. Gas is still being occasionally produced in small quantities from two existing production wells, the Piacentine 1-27 and the Citizen Green 1, drilled in December 2011. The size of the air bubble proposed for the compression test will be limited to approximately 0.5 Bscf, or 0.56 Bscf if an optional ambient air injection test is conducted (Attachment H), which is approximately 4% of the original gas in place and sufficient to test the reservoir performance at a pilot scale.[8]

The discovery pressure (reservoir pressure prior to gas production) of the gas field was approximately 2,080 pounds per square inch (psi), as determined from the Moresco et al. Unit A 1 well. The discovery pressure is believed to represent the normal hydrostatic gradient for the reservoir sands. Based on production information available from the California Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR), it is estimated that the reservoir pressure fell as low as 1,000 psi, but recovered slowly to near the discovery pressure after production ceased, and is currently fairly stable at approximately 1,910 psi (Attachment A-1; Table G-5). Pressure data indicate that pressure in the reservoir increases slowly when no gas is being produced or gas production is nominal; however, current production of small amounts of attic gas from the Citizen Green 1 well are believed to be keeping pressures relatively stable. The historic pressure drop and rebound to a slightly lower pressure followed by slower recovery, indicate the gas reservoir has a moderate water drive (*i.e.*, it has an attenuated connection to a more regional aquifer within the Mokelumne River Formation through the bottom of the reservoir). Injection flow rates are expected to range up to approximately 14 million standard cubic feet per day (MMscfd). To achieve these injection rates, the maximum (worst case) bottomhole pressure will be no more than 2,500 psi (2,200 psi wellhead pressure). It should be noted that the compression equipment will be provided with a high pressure shut down interlock, such that this pressure will not be exceeded. Based on modeling and permeability data, the actual pressures required to drive the target flow rates are projected to be somewhat lower, approximately 2,350 to 2,465 psi maximum (2,050 to 2,165 psi wellhead pressure), and the maximum pressure buildup at existing wells completed in the reservoir is predicted to be approximately 2,070 to 2,133 psi (see Attachment A-2). Because the reservoir is pressure depleted, this pressure is only 15 psi to 68 psi over the normal hydrostatic gradient. The duration of these pressure increases is predicted to be relatively limited as pressure equilibrates with the underlying aquifers in the Mokelumne River Formation.

[8] The final air bubble volume in place in the reservoir will be dependent on the amount of air blown down after the test, and may be significantly less than the maximum bubble size.

2.3 COMPRESSION TESTING EQUIPMENT

A summary description of the proposed compression test facilities is presented below. The primary equipment used during the compression test will include the following (Attachment H):

- The proposed Injection/Withdrawal Well;
- Two monitoring wells (including the nearby Piacentine 1-27 and Piacentine 2-27 wells, which will be modified and instrumented as needed);
- A high pressure nitrogen generation and compressor train capable of injecting the compressed oxygen-depleted air (or ambient air, if determined to be safe) at flow rates up to 14 MMscfd and compressor outlet pressures up to a maximum of 2,200 psi;
- An after cooler to cool the compressed air to a temperature no higher than approximately 140 °F prior to injection into the reservoir;
- Appurtenant equipment to support compression and injection operations including a temporary electrical supply, a step down transformer, a power distribution system, a compressor cooling system, high pressure piping, and control circuitry; and
- Equipment to support withdrawal testing will include high pressure piping, a choke valve, a line heater, a 2-phase separator, one or more produced water storage tanks, and an air discharge vent stack.

2.4 MONITORING AN D MEASURING EQUIPMENT

Monitoring and measurement equipment will be used to collect technical data from the test, to monitor process operation and safety, and to gather permit compliance data. A complete description of the proposed monitoring and measurement equipment is presented in Attachment H. A summary of the equipment to be used is presented below:

- Two existing wells will be used as monitoring wells (Piacentine 1-27 and Piacentine 2-27);
- Wellhead pressure and temperature sensors will be installed at the Injection/Withdrawal Well and Piacentine 1-27;
- Permanent downhole pressure and temperature sensors will be installed in the Injection/Withdrawal Well, and a memory gauge pressure-temperature sensor will be periodically lowered into Piacentine 1-27;
- Annular pressure sensors will be installed at the Injection/Withdrawal Well and Piacentine 1-27;
- Instrumentation installed on the piping leading to the Injection/Withdrawal Well will include a pressure-temperature gauge, differential pressure flow sensor, and gas analyzers for oxygen and combustible gas;
- A water level sensor will be installed in the produced water tanks;

- A hybrid data acquisition, control and safety system equipped with a data historian will permanently record compliance, test and performance data;
- The control and safety system will include alarms and safety shutdown interlocks for high pressure, low pressure, high combustible gas, and high oxygen.

Additionally, wireline logs (*i.e.*, gamma and pulsed neutron spectrometry) of the monitoring wells will be conducted periodically during the test to assess the size and growth of the air bubble over time. Sampling ports will be provided along the injection and discharge lines near the wellhead to collect injection as well as withdrawal gas samples for field testing and laboratory chemical analysis.

2.5 COMPRESSION TESTING PROCEDURES

The conceptual compression test injection and withdrawal rates, schedule and total bubble size over time are summarized in Table 2-1, below, and discussed in detail in Attachments H, I, K and P. In addition, the various test phases are shown graphically in Figure 4.

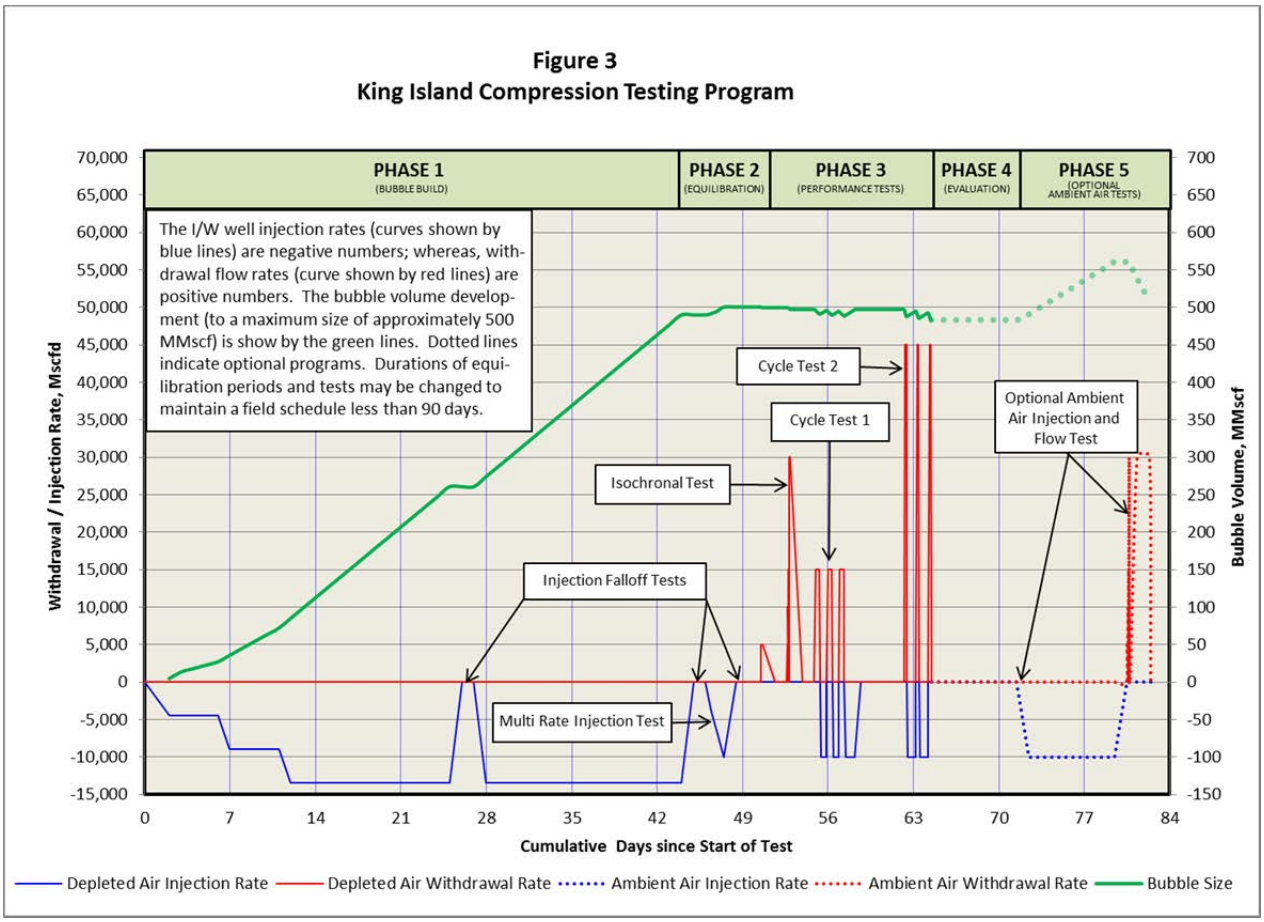
Table 2-1: Summary of Compression Testing Program Phasing and Activities

Test Phase		Test Activity	Tentative Duration [1]
1	Bubble Building	N_2 injection at up to 14 MMscfd	44 days
		Injection fall-off test (FOT)	2 days
2	Bubble Equilibration Period	Shut-in / FOT	2 days
		Multi-rate injection test up to 10 MMscfd	1.5 days
		Shut-in / FOT	3 days
3	Withdrawal/Injection Cycle Testing	Well clean-up	4 hours
		Shut-in / Equilibration	2 days
		Isochronal test (flow after flow) at up to 30 MMscfd	8 hours
		Shut-in / FOT	2 days
		Series 1 N_2 injection/withdrawal/shut-in cycling with injection up to 10 MMscfd and flow up to 15 MMscfd	3 ½ days
		Shut-in / Equilibration	4 days
		Series 2 N_2 injection/withdrawal/shut-in cycling with injection up to 10 MMscfd and flow up to 45 MMscfd	3 ½ days
4	Preliminary Data Evaluation and Post-Test Equilibration	Evaluate data, PG&E decision regarding further testing (optional) [4]	7 days
5	Additional Testing Using Ambient Air (if directed)	Injection of ambient air at up to 10 MMscfc followed by flow testing up to 25 MMscfd [4]	11 days

Notes:

1. Actual durations of the test phases may change somewhat based on the equipment mobilized and equipment performance under field conditions; however, the total test duration will be approximately 90 days. The test will be followed by a post-test monitoring period up to approximately 6 to 9 months.
2. N_2 = oxygen-depleted air with an oxygen content less than approximately 5 %.
3. MMsfd = million standard cubic feet per day.
4. The bubble may be blown down during Phase 4 and after Phase 5 to decrease pressures and bubble size, if needed and to the extent it can be done safely

Figure 3
King Island Compression Testing Program



During the above tests, regular pressure, temperature, injection rate, flow rate, water production and gas chemistry measurements will be collected and recorded using an automated data acquisition system. Additional measurements will be made in the field and selected process gas samples will be submitted for laboratory analysis.

2.6 SCHEDULE

In order to meet the project objectives prescribed by DOE within the grant's duration, the compression test is currently scheduled to commence in June 2014 with the drilling and construction of the Injection/Withdrawal Well. In addition, as part of the same driller mobilization, we propose to modify the existing Piacentine 1-27 gas well to serve as a monitoring well (for pressure and temperature

monitoring as well as logging). The recently installed Piacentine 2-27 will also be used as a monitoring well (for logging purposes only), but will not require modification. Coincident with the drilling of these wells and tentatively continuing into July 2014, the temporary site facilities necessary for the compression test will be constructed. The compression test is tentatively scheduled to commence in July/August and to continue for approximately three months, into September/October 2014. Post-test monitoring will continue for approximately six to nine months.

3.0 UIC PERMIT REQUIREMENTS

The table below presents a summary of the required UIC permit attachments that are included with this report, the approach utilized in addressing them, and any proposed deviations from typical requirements for a Class I injection well.

TABLE 3-1: DESCRIPTION OF PERMIT ATTACHMENTS AND DEVIATIONS FROM CLASS I REQUIREMENTS

Permit Attachment	Approach	Deviation from Class I Requirements
A: Area of Review	The Area of Review has been designated based on a review of reservoir and USDW geology, and pressure modeling to establish the Zone of Endangering Influence plus application of a default ¼-mile radius where the ZEI is less than ¼ mile from the well. The analyses performed support an Area of Review that encompasses the lateral limits of the gas reservoir plus a default minimum ¼ -mile radius from the proposed Injection/Withdrawal Well that extends outside the reservoir boundaries to the north.	None
B: Maps of Well/Area and Area of Review	Maps have been prepared showing surface features, existing and proposed well surface and bottomhole locations, and the established Area of Review as shown on Figure B-1.	None
C: Corrective Action Plan and Well Data	Existing artificial penetrations (wells) within the Area of Review were reviewed in terms of their completion and cementing details (for active and shut in wells) or their plugging and abandonment details (for plugged and abandoned wells). In addition predicted pressures in the target injection formation at the well locations were evaluated to determine whether the maximum anticipated pressure increase could mobilize fluid flow through the well bores. It was determined that corrective actions are not warranted for existing wells. A program was developed to convert the existing Piacentine 1-27 well for use as a monitoring well, including insertion of a tubing and packer system with a pressurized annulus to isolate the well casing form the tubing contents and provide an additional layer of protection. This program is intended to comply with EPA requirements to prevent the potential for communication between the target injection zone and overlying USDWs.	F.1 Several AOR wells were not plugged or completed with cement at the base of USDW in accordance with EPA standards; however, these wells are completed with annular cement above the injection zone which is expected to provide adequate protection against upward flow of gas, air or formation fluids into USDW and other formations. Given that the existing condition of the wells would be protective of USDW during the proposed pilot test and that a corrective action requirement could jeopardize the ability to conduct the test, the fact that corrective action is not proposed appears consistent with EPA guidance.
D: Maps and Cross Sections of USDW	This section includes maps and cross sections showing the extent and depth of USDW.	None
E: Name and Depth of USDWs	We have determined the depth of USDW based on two methods of geophysical log analysis calibrated to laboratory analysis of a formation water sample from the core well drilled at the site. This attachment describes the methodology used.	None

Permit Attachment	Approach	Deviation from Class I Requirements
F: Maps and Cross Sections of Geologic Structure of Area	Maps and cross sections have been developed based on regional geologic data, well log data obtained from DOGGR, seismic survey data interpretation, and information derived from the core well drilled at the site.	None
G:Geological Data on Injection and Confining Zones	A narrative description of the site geologic setting, injection and confining zones is included.	None
H: Operating Data	Details are provided regarding the proposed use of the Injection/Withdrawal Well including injection rates, pressures, volumes, flow rates, temperatures and nature of the injected/flowed gas.	None
I: Formation Testing Program	Information is provided regarding the proposed core sample analysis and field logging program for the Injection/Withdrawal Well, Step Rate Testing to establish the maximum tolerable injection pressure, and formation testing that will be conducted during the compression test.	None
J: Stimulation Program	A stimulation program is presented, but will only be implemented if needed.	None
K: Injection Procedures	A process flow diagram and description of injection procedures is included.	None
L: Construction Procedures	Construction procedures are consistent with Class I well requirements.	None
M: Construction Details	A diagram showing construction details is included.	None
N: Changes in Injected Fluid	We have provided a narrative summary of the anticipated movement and changes of air and water in the subsurface as a result of the proposed air injection and compression testing. An evaluation of potential chemical changes in the reservoir as a result of air injection is included.	None
O: Plans for Well Failures	A contingency plan is included.	None
P: Monitoring Program	An outline of the proposed monitoring program during and after the compression test is provided.	F.2 Mechanical integrity testing is proposed to be performed 90 days after the well is put into services in order to avoid interrupting the Compression Test. After the Compression Test the wells will either be shut in and put on inactive status or plugged and abandoned, so ongoing Mechanical Integrity Testing or Fall Off Testing after the initial tests is not proposed.
Q: Plugging and Abandonment Plan	A plugging and abandonment program for the Injection/Withdrawal Well is included.	None
R: Necessary Resources	Evidence is provided of commitment of the necessary resources for well plugging and abandonment.	None
S: Aquifer Exemptions	Not applicable.	None

Permit Attachment	Approach	Deviation from Class I Requirements
T: List of Permits	This section lists existing and planned local, state and Federal permits for the proposed I/W Well and compression test.	None
U: Description of Business	A description of PG&E's business and the scope and objective of the proposed project has been included.	None

On March 1, 2007 EPA issued a guidance document for Class V wells, which recognized that "most pilot projects are assumed to be small enough (low volume and or/use of food-grade CO2) that remediation would not be an issue." The proposed injected volume of this CAES testing program is small in comparison to the overall reservoir volume, and after the completion of testing the reservoir pressure will be allowed to return to below the original hydrostatic pressure, eliminating the potential threat to the USDW from the testing activity. As such, the proposal in this permit application not to conduct corrective action on wells that are not completed to EPA standards is considered consistent with EPA policy as long as it can be demonstrated that USDW is protected from the effect of pressure increases resulting from the test.

The Injection/Withdrawal Well will be used to perform injection and flow testing for a period of up to approximately 90 days, after which the Injection/Withdrawal Well and the Piacentine 1-27 and 2-27 monitoring wells will be shut in and post-test pressure monitoring will be performed for a period of six to nine months using the existing wellhead and down-hole sensors. Computer modeling indicates that pressures will slowly dissipate in the reservoir as water flows into the underlying aquifers. At the end of the monitoring period, if reservoir pressures have fallen below the normal hydrostatic gradient, the Injection/Withdrawal Well will be maintained in an inactive status until such time that the field operator either obtains a new permit or the well is plugged and abandoned. Annual Mechanical Integrity Testing would not be performed under this circumstance. The monitoring wells are being leased from the gas field operator for the duration of the compression test and post-test monitoring, and ownership of the monitoring wells would be transferred back to the operator if pressures fall below the normal hydrostatic gradient.

Conversely, if pressures remain above the normal hydrostatic gradient, the Injection/Withdrawal Well will be plugged and abandoned in accordance with EPA requirements as described in Attachment Q. However, because PG&E does not own the monitoring wells, PG&E would work with the current field operator to ensure compliance with the EPA permit requirements.

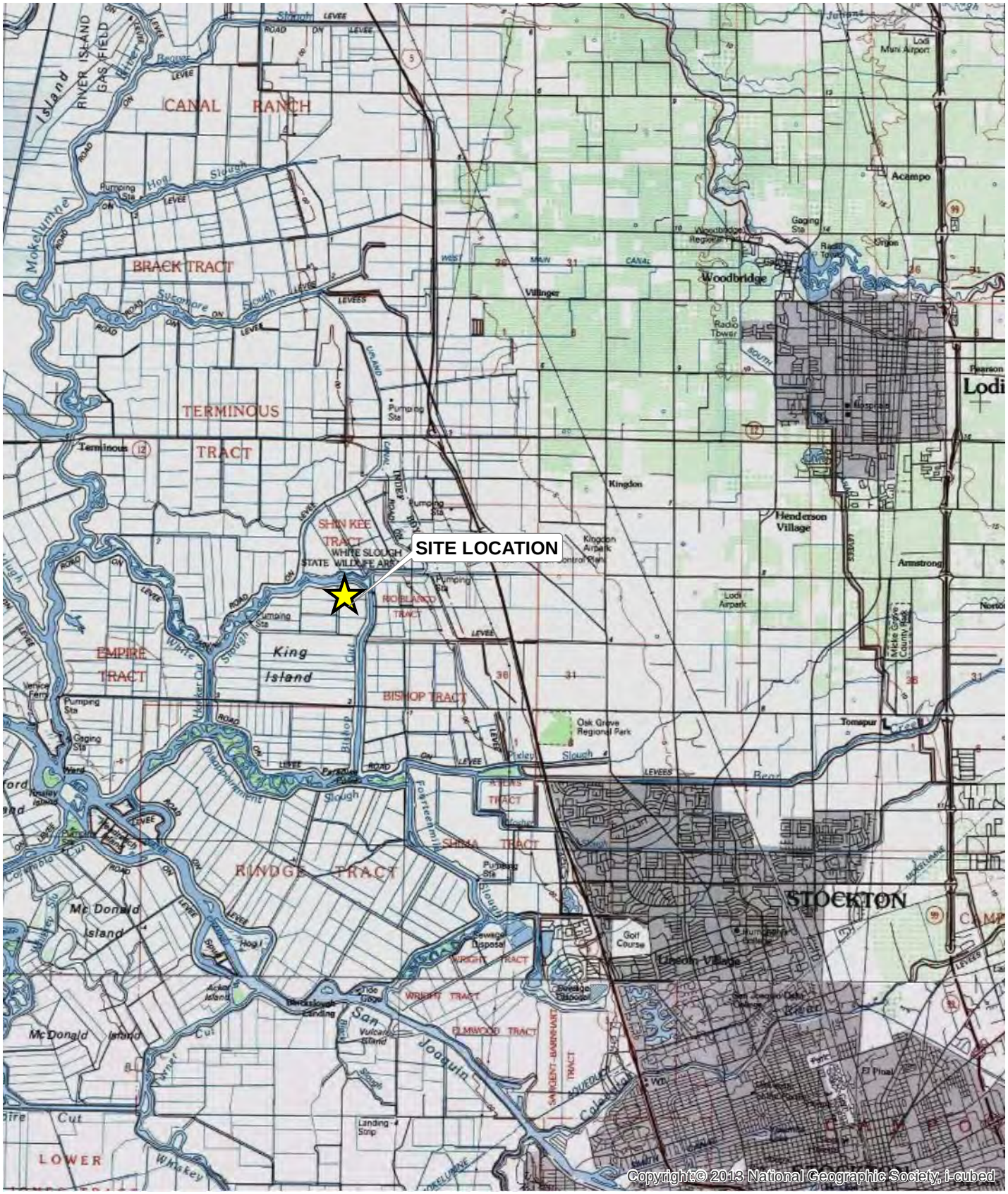
The proposed approach to construction and Operation of the proposed experimental Class V Injection/Withdrawal well is believed to entail considerably less risk than a Class I wastewater injection well and to be protective of USDW with a considerably greater margin of safety for the following reasons:

- The medium being injected is air (primarily oxygen-depleted air), which is less viscous and more compressible than fluid injectate, and has a lower potential for causing contamination of USDW than waste water.

- The well will only be used for approximately 90 days and the likelihood of well failure during this short time period is remote.
- Injection will take place into a relatively high permeability reservoir with proven seals, as demonstrated by the accumulation of natural gas over millions of years.
- Most of the original gas in place has been produced, and the volume of air to be injected is much less than the original volume of gas that was held in the reservoir (approximately 4 %).
- The maximum bottomhole pressure will be less than 2,500 psi, and based on modeling is expected to be closer to 2,350 to 2,465 psi. Pressures at wells in the AOR are expected to increase to approximately 2,070 to 2,133 psi, which is only 15 psi to 68 psi over the normal hydrostatic gradient. After completion of the test, residual pressures are predicted to fall off over time. Thus, artificial penetrations that could connect the injection reservoir to overlying USDW would only be exposed to increased pressures for a limited period of time.
- Despite these distinguishing characteristics that inherently make use of the well of lower risk to USDW than a waste fluid injection well, the adopted design and operation approach follows that of Class I waste water injection well.

FIGURES

FIGURES



NOTE

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **PACIFIC GAS AND ELECTRIC COMPANY**	LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	DATE: 12/17/13
	TITLE: ***SITE LOCTION MAP***	FIGURE: **1**

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Legend

- PROPOSED I/W WELL SURFACE LOCATION
- PROPOSED I/W WELL BOTTOM HOLE LOCATION
- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- ALIGNMENT OF DEVIATED WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND

Notes

ALL ELEVATIONS ARE SUBSEA

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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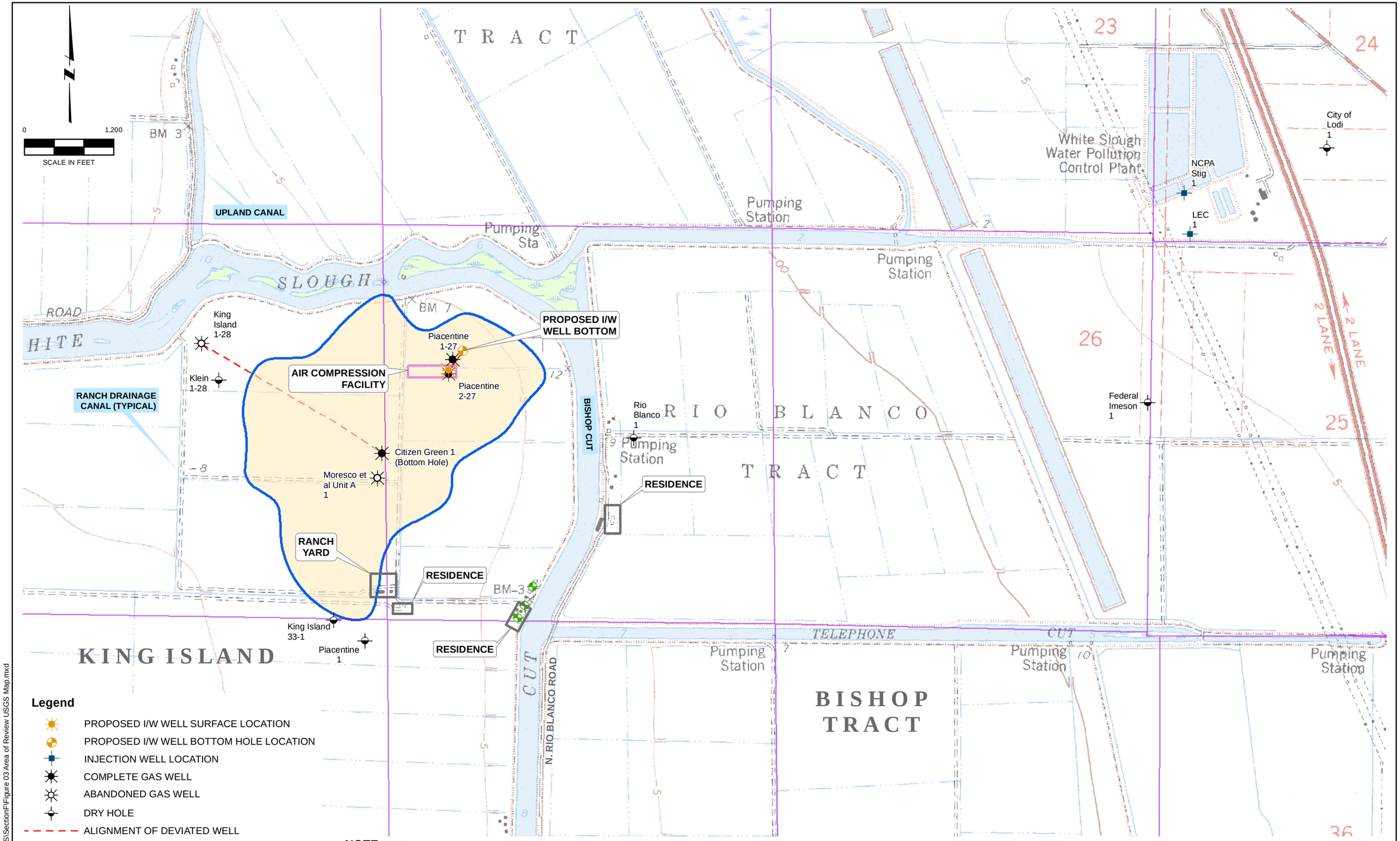
Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT No.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/19/13	PEM	RF

FIGURE 2

KING ISLAND
RESERVOIR AND WELL LOCATIONS



Legend

- PROPOSED I/W WELL SURFACE LOCATION
- PROPOSED I/W WELL BOTTOM HOLE LOCATION
- INJECTION WELL LOCATION
- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- ALIGNMENT OF DEVIATED WELL
- DOMESTIC WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- FARM IRRIGATION/DRAINAGE CANAL
- SECTION LINES

NOTE

FIGURE PREPARED BY:
JACOBSON, JAMES
& ASSOCIATES, INC.

Path: J:\GIS\WPPGE_CAES\Section\Figure 03 Area of Review USGS Map.mxd

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT No.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/30/13	PEM	RF

FIGURE 3

TOPOGRAPHIC MAP SHOWING SITE AND VICINTY

ATTACHMENT A

Area of Review

CONTENTS

Section A-1 Requirements

Section A-2 Background and General Approach

Section A-3 Air Bubble Formation and Volumetric Material Balance

Section A-4 Modeling to Establish the Zone of Endangering Influence

Section A-5 Determination of Area of Review

Section A-6 References

Table A-1 Geologic Data for Mokelumne River Formation Model

Table A-2 Key Input Parameters for Mokelumne River Formation Model

Table A-3 Summary of Depth Discreet Pressure Data

Table A-4 Maximum Predicted Pressure Buildup in King Island Gas Field Wells – Reasonable Conservative Case (ShKl)

Table A-5 Key Input Parameters for Combined Mokelumne River Formation – Meganos Channel Fill Model

Table A-6 Calculated Hydrostatic Pressures in the Uppermost Mokelumne River Formation at Existing King Island Gas Field Wells

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Attachment A-1 Mokelumne River Formation Pressure Buildup Model Calculations and MODFLOW Inputs

Attachment A-2 Mokelumne River Formation Pressure Buildup Model Results

Attachment A-3 Meganos Channel Sand Pressure Buildup Model THWELLS Inputs and Results

Attachment A-4 King Island Gas Reservoir Well Production and Pressure Data

Attachment A-5 Bottomhole Pressure Measurements from Piacentine 1-27 and Citizen Green 1 on February 12, 2014

A.1 REQUIREMENTS

UIC regulations require that an Area of Review (AOR) be established around a new injection well for the investigation of possible pathways for out-of-zone migration of injection fluids into Underground Sources of Drinking Water (USDW). The AOR should encompass the area where pressure buildup as a result of injection could result in upward flow of fluid from the injection zone into a USDW through artificial penetrations or natural conduits in the area, if these exist. This section gives the methods and the calculations used to determine the size of the area of review. Regulations require that a minimum AOR for a Class I non-hazardous injection well is a fixed radius of ¼ mile (1,320 feet) around the injection well; however, the radius may be larger as defined by site-specific conditions.

The background and general approach to establishing the AOR is discussed in Section A.2. Additional information regarding the bubble formation process is described in Section A.3. An evaluation of potential pressure buildup as a result of the proposed compression test to establish the Zone of Endangering Influence (ZEI) is discussed in Section A.4. The designation of the AOR is discussed in Section A.5.

A.2 BACKGROUND AND GENERAL APPROACH

For the PG&E Compressed Air Energy Storage (CAES) compression testing program, air will be injected into originally gas-bearing permeable sands of the Upper Cretaceous Mokelumne River Formation. To facilitate the compression test, an Injection/Withdrawal Well will be completed in the depleted King Island gas reservoir, which occurs at the top of an elliptical-shaped erosional remnant of upper Mokelumne River Formation that is eroded on all sides by the Paleocene Meganos Channel Fill (Figure A-1 and A-2). The reservoir is sealed on the sides by shale deposited along the flanks of the Meganos Channel, and is capped by the Eocene Capay Shale. Approximately 80% of the original natural gas has been produced from this reservoir; however, a small amount of gas remains as attic gas or free gas in the top of the reservoir structure, while the rest of the reservoir has been invaded by water inflow from an underlying aquifer leaving trapped gas and water in this invaded zone. The geology of the Mokelumne River Formation and the King Island gas reservoir is discussed in detail in Attachment F and G, and summarized below.

Overall, the Mokelumne River Formation is a coarsening upwards sequence of sediment packages deposited in a prograding delta. The uppermost sequence at King Island consists of sandstones with a net composite thickness ranging from about 65 to 175 feet. This includes the gas reservoir sands above the original gas-water contact as well as similar underlying sands that are underlain by shale and siltstone, which in turn are underlain by three additional sediment packages that consist of sand grading downward into siltstone and shale. The lowermost sediment package is the finest grained and grades downwards into the H&T Shale. The net composite thickness of Mokelumne River Formation in the erosional remnant is up to approximately 1,600 feet (Figure A-1).

In terms of hydrogeology, the sediments in the King Island erosional remnant consist of packages of permeable aquifer sands separated by lower permeability siltstone, mudstone and shale that act as aquitards. Overall, the sand packages decrease in permeability with depth. The gas reservoir at the top of this sequence has been mostly invaded by water and together with the sands immediately below the original gas-water contact comprises the uppermost aquifer in this sequence. Collectively, this uppermost aquifer is referred to as the "gas reservoir" or "gas reservoir sand" in this Attachment. The average horizontal permeability of sands in the King Island gas reservoir is approximately 807 millidarcies (mD), based on the average of permeability measurements (converted to reservoir confined stress permeability) from laboratory analysis of core samples retrieved from the Piacentine 2-27 core well (Table G-1). The permeability of the sands in the next deeper package (designated herein as MR2) is somewhat lower than the gas reservoir sands (Table G-4). The permeability of sands in the MR3 and upper portion of the MR4 is approximately 10 to 19 mD (Table G-4). The lower 300 feet of the MR4 generally consists of siltstones, mudstones and shale that effectively form a basal aquitard layer that grades downwards into the H&T Shale. In summary, the MR2, MR3 and upper MR4 sand packages comprise a series of saline aquifers with an attenuated hydraulic connection to each other and to the water-invaded gas reservoir at the top of the structure.

The permeable sands of the Mokelumne River Formation, including the gas reservoir and the underlying saline aquifers, comprise the injection zone that will experience increased pressures as a result of the proposed air injection. As air is injected into the King Island gas reservoir, the displacement of natural gas and water will cause pressures within the water-invaded gas reservoir sands in the uppermost portion of the King Island erosional remnant to increase. Based on the relatively high permeability of these sands, this pressure increase will propagate throughout the reservoir sands relatively rapidly. The increase in pressure will cause water to flow slowly out of the reservoir through the underlying shale and siltstone and into the underlying aquifer sequence. The displacement and outflow of water from the reservoir sands will propagate downwards through the sequence of sandstone aquifers and intervening siltstone and shale aquitards, until it reaches the thick aquitard sequence in the lowermost portion of the Mokelumne River Formation, through which it will propagate laterally. In addition, water flow and pressure will take place laterally in each aquifer until it reaches the relatively impermeable shales deposited at the edge of the Meganos Channel (assuming, as is likely, that these act as barriers to water flow and pressure propagation). Based on this conceptual understanding, the lateral propagation of pressure associated with the proposed Injection/Withdrawal Well would be limited by the lateral extent of the reservoir and aquifer sands of the King Island erosional remnant as shown on Figure A-3.

Notwithstanding the above, the possibility that the Mokelumne River Formation aquifers beneath the gas reservoir have sand-on-sand contacts with the adjacent Meganos Channel fill cannot be conclusively ruled out. As such, there are two possible paths of communication for pressure propagation to occur beyond the lateral boundaries of the King Island gas reservoir .

Case A - Downward pressure propagation through the MR2, MR3 and MR4 sands, and then laterally outwards through the lower MR4. The attenuating effect of the lower permeability layers separating the MR-2, MR-3 and MR-4 sand packages and the aquitard at the base of the MR4 will tend to significantly limit this route of pressure propagation.

- The lateral and vertical upward boundaries of the King Island gas reservoir are considered effectively impermeable seals through which pressure propagation cannot occur since they acted as effective seals for gas accumulation. The nature and adequacy of the gas reservoir seals is further discussed in Attachment G.
- The lateral boundaries of the underlying Mokelumne Formation sandstones, where they are truncated by the Meganos Channel, are also likely to be aquifer boundaries since abundant shale has generally been found to be present along the flanks of the channel fill (Attachment G).
- The propagation of pressure downwards vertically through the aquifer sequence that underlies the gas reservoir was evaluated by computer modeling as described in Section A.4.1. The approach taken was to assess the potential pressure buildup in the reservoir, the uppermost MR2 sands, lower MR2 sands, and the combined MR3/MR4 sand packages to establish the Zone of Endangering Influence (ZEI) vertically within the Mokelumne River Formation.

Case B - Sand-on-sand contacts between sands deposited in the Meganos Channel fill and the King Island erosional remnant. As indicated above, it is possible, though unlikely, that sand-on-sand contacts could allow the lateral propagation of water flow and pressure laterally beyond the boundaries of the Mokelumne River Formation beneath the gas reservoir. Core testing of Meganos Channel Fill sandstone at the East Islands gas field indicates that the lithology and permeability of these sandstones is generally similar to those of the Mokelumne River Formation (Attachment G-2). This is expected, since these deposits essentially consist of reworked Mokelumne River Formation sands derived from more proximal portions of the channel.

- The propagation of pressure laterally through potential sand-on-sand contacts between the Mokelumne River Formation and the Meganos Channel was evaluated by computer modeling as described in Section A.4.2. The approach taken was to assess the areal pressure buildup distribution based on the assumption that an aquifer sand unit in the Mokelumne River Formation is hydraulically connected to a similar sand unit in the Meganos Channel fill, and that together they act as a laterally continuous aquifer through which flow and pressure propagation can occur without significant impedance. The effect of a potentially impermeable fault boundary south of the King Island gas reservoir to increase pressure buildup was also considered.

- Computer modeling based on this assumption should predict the maximum lateral distance of pressure buildup beyond the boundaries of the King Island erosional remnant if a sand-on-sand contact exists, and establish the lateral limits of the ZEI.

A.3 AIR BUBBLE FORMATION AND VOLUMETRIC MATERIAL BALANCE

As discussed in additional detail in Attachment H, the Injection/Withdrawal (I/W) Well will be completed in approximately the upper 40 feet of reservoir sands in the Mokelumne River Formation, and a volume of non-hazardous oxygen-depleted air (approximately 0.50 billion standard cubic feet "Bscf") will be injected into the depleted natural gas field beneath the confining shale formations. An additional volume of up to 80 million standard cubic feet (Mscf) of ambient air may be injected if it is determined prudent to do so based on the results of the oxygen-depleted air injection testing. The maximum net volume of injected air in the reservoir at any time, taking into account withdrawn volumes, will be approximately .56 Bscf. The air injection program is discussed in Attachment H and shown graphically on Figure H-1. The compression testing program will occur over a period of up to approximately 90 days, after which the Injection/Withdrawal Well will be shut in and monitored for up to one year.

The original gas-filled pore space of the gas reservoir has been largely invaded by water following the cumulative gas production of 10.5 Bscf, leaving only a small attic gas cap at the structurally high portions of the field and trapped gas in the water-invaded zone between the original gas-water contact and the current gas-water contact. The Injection/Withdrawal Well will be completed within and immediately below this gas cap. The injected air will displace the formation water along with any free or trapped native natural gas surrounding the well during the building of the air bubble. The air bubble is expected to build from the top down in the reservoir sands, due to the density difference between air and water.

A volumetric material balance calculation is presented in the table below to predict the approximate size of the air bubble that will be created during the project. The air bubble size is dependent on the reservoir sand porosity, the residual water saturation in the air bubble, the volume and compressibility of the air at reservoir pressures, the volume and compressibility of the remaining free gas in the reservoir. Assumptions regarding these characteristics are presented below. The compressed volume of the air bubble and the degree to which remaining native gas will be compressed is dependent on the reservoir pressure, which was evaluated by modeling as discussed in Section A.4.1. Based on the pressure modeling results, the average pressures in the reservoir is predicted to temporarily increase up to an average of approximately 2,300 pounds per square inch absolute (psia) in the vicinity of the air bubble.[1] This is an increase of approximately 250 psia over the normal hydrostatic pressure, and an increase of approximately 400 psia over the current reservoir pressure.[2] The average predicted pressure across the area of the reservoir where the remaining free native gas is located is approximately 2,100 psi.[3]

[1] Derived from the average predicted pressure buildup in the Injection/Withdrawal Well and Piacentine 1-27 well in the reasonable conservative (Sh/Kl) modeling case discussed in Section A.4.1.

[2] Calculated based on a normal hydrostatic gradient of 0.439 psi/foot and a current hydrostatic gradient of 0.407 psi/foot, as discussed in Section A.4, and a depth to the top of the Mokelumne River Formation at the proposed

The expected air bubble volume, and volume of displaced formation water, are calculated below. The actual bubble surface is more likely to be parabolic, but a cone shape has been used for calculation purposes.

AIR BUBBLE AND DISPLACED PORE WATER VOLUMETRIC CALCULATION

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1910	psi
Average Reservoir Pressure after injection =	2100	psi
Average Reservoir Pressure near air bubble =	2300	psi
z(air) =	0.986	
z(natural gas) =	0.865	
Reservoir Temperature =	120	Deg F

Volumetric Calculations:

B_g (air) =	142.17	scf/ft^3
B_g (natual gas) =	162.41	scf/ft^3
V (Gross volume air bubble) =	463.7	acre-feet
Pore Volume of Air in Bubble =	90.4	acre-feet
=	29,463,021	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,923,418	gallons
V (Post Injection Reservoir Volume of natural gas) =	46,073,690	gallons
Pore Volume Freed by Gas Compression =	9,849,728	gallons
Total Net Pore Volume Displaced by Air Injection =	19,613,294	gallons

Injection/Withdrawal well of 4,681 feet below ground surface, as interpolated from Figure F-13 and a surface elevation of approximately -4 feet.

[3] Derived from the average predicted pressure buildup in the Piacentine 2-27 and Moresco et al. Unit A #1 wells in the reasonable conservative (Sh/Kl) modeling case discussed in Section A.4.1.

Dimensional Calculations:

Assuming a Cone-shaped Air Bubble:

Vb = 1/3 x h x A

A = 3 x Vb / h

A = 3.141 r^2

	h=60 ft	h=50 ft	
Bubble Area, A =	23.2	27.8	acres
Max bubble radius, r =	567	621	feet

The results of the above calculations indicate that for a final test bubble size of 560 MMscf, the calculated theoretical radius of the air/water contact in the target injection zone is approximately 600 feet from the Injection/Withdrawal Well, assuming a cone-shaped air bubble and a bubble height of 50 to 60 feet at the wellbore. The air bubble will occupy approximately 4 percent of the space previously taken up by natural gas within the reservoir. Based on the above-calculated maximum bubble size of approximately 463.7 acre-feet, average porosity of 30%, and residual water saturation in the air bubble of 35%, the amount of pore space taken up by the air bubble will be approximately 29,400,000 gallons (700,000 reservoir barrels [rbbl]). Some of the space taken up by the air bubble will be derived from compression of the remaining natural gas in the reservoir. The remainder will be created through the displacement of pore water from the reservoir sands. Approximately 9,800,000 gallons (230,000 rbbl) of reservoir space will be created by compression of the remaining natural gas remaining in the gas reservoir, so the proposed air injection program will displace approximately 19,600,000 gallons (470,000 rbbl) of water. The displacement will take place over a period of approximately 76 days, which would therefore be equivalent to a net average water injection rate of approximately 180 gallons per minute (gpm) (6,200 bbl/day).

A.4 MODELING TO ESTABLISH THE ZONE OF ENDANGERING INFLUENCE

A.4.1 Case A - Simulation of Pressure Buildup in the Mokelumne River Formation

Modeling Code Selection

The computer simulations of pressure buildup in the Mokelumne River Formation were performed using MODFLOW 2000, a block-centered, finite difference groundwater flow modeling code created for the United States Geological Survey (USGS) in 1984 and updated a number of times since that time (Harbaugh, et al., 2000). This versatile code views a three-dimensional system as a sequence of layers of porous material capable of simulating confined, leaky confined, unconfined and water table aquifers. The model is set up as a series of modules where a user can incorporate all attributes and boundary conditions of a particular natural system independently. MODFLOW has been widely used for simulating the effects of pumping or injection wells for regulatory permits, and supports creation of models to simulate systems

ranging from simple two-dimensional aquifers to complex three dimensional aquifer systems, with the flexibility to simulate aquifer conditions and boundary conditions in a variety of ways.

Assumptions and Limitations

MODFLOW simulates single-phase water flow; however, adjustments were made to simulate injection of an amount of water equivalent to the pore water displaced during air injection. In addition, the effect of trapped gas remaining as small bubbles within the pore space of the water-invaded zone above the original gas-water contact was addressed by calculating an increased specific storage and diminished permeability for the uppermost model layer (Attachment A-1). The implications of these assumptions were tested by performing several model sensitivity runs.

Modeling was performed using a superposition approach; that is, the outputs reflect only the contribution of changes resulting from the compression test.

Conceptual Model and Approach

The model concept assumes the existence of impermeable (no-flow) aquifer boundaries at the lateral edges of the King Island erosional remnant. The pressure in the aquifers underlying the King Island gas reservoir would increase as the result of vertical movement of water out of the gas reservoir, through the underlying lower permeability shale and siltstone, and into the underlying MR2, MR3 and MR4 aquifer sands. The maximum pressure increase would occur within the gas reservoir, which is encased on the top and sides by impermeable shales, and on the bottom by a semi-permeable aquitard. Similar to the pressure recovery when gas production ceased or slowed in the gas field (Section A.5 and Attachment A-1), pressure buildup in the underlying aquifers would occur as water flows vertically through the aquitard. The pressure buildup would be impeded vertically as flow occurs through each aquitard, and would decrease vertically downward.

To evaluate pressure buildup, a multi-layer model was constructed to simulate water flow and pressure propagation vertically downward and laterally outward through a sequence of aquifers and aquitards that represents the general geometry and properties of the Mokelumne River Formation erosional remnant at King Island. The compression test was simulated by injection of an amount of water equivalent to the pore water displaced by air injection into the upper portion of the water-invaded gas reservoir. Flow testing was simulated as water withdrawal.

Model Implementation

Figures showing the model discretization, including the domain boundaries, grid, layer dimensions, boundary conditions, and model calibration are presented in Attachment A-1. Attachment A-1 also presents a summary of the rationale for the assigned aquifer parameters, as well as details regarding the assumptions and calculations that have been made to develop the model.

MODEL DOMAIN

Two separate model domains were established, both of which were centered approximately on the King Island gas field. The domains were established for high (Kh) and low (Kl) hydraulic conductivity cases defined for the sensitivity runs, as discussed below. A grid-cell size of 200 by 200 feet was used throughout most of the domains, except near the injection point, where the cell size was reduced to 10 feet by 10 feet to allow better resolution. These model domains are illustrated on Figure A-1. The geologic basis for the model design is summarized in Table A-1. The model was built using nine layers to simulate four generalized aquifer units and four aquitard sequences as shown on Table A-2. The uppermost layer, representing the reservoir sands, was subdivided into two layers to represent the net sand above and below the original gas-water contact.

BOUNDARY CONDITIONS

The lateral boundaries of the layers were established at the corresponding subcrop boundaries shown on Figure A-3. No-flow boundaries were established for the upper eight layers at the subcrop boundaries. For the ninth layer, no-flow boundaries were established to the south and east, where the Meganos Channel truncates the Mokelumne River Formation (Figure A-1). General-head boundaries were established at the edge of Layer 9 at the remaining locations, which were set to 0 psi (i.e., hydrostatic pressure in the superposition model described herein).

AQUIFER PARAMETERS

The thicknesses and properties assigned to each layer are summarized in Table A-2 and on Figure A-4. Two key input parameters span a significant range depending on how they are calculated: (1) the specific storage of the water-invaded sands above the original gas-water contact and (2) the vertical permeabilities of the aquitards. The remaining properties are considered to be relatively well-constrained by the available data.

No laboratory vertical permeability measurements of the aquitard materials between the reservoir and Upper MR2 are available. Well-log interpretation indicates that the aquitard is vertically heterogeneous and contains a significant amount of shale and other low permeability materials interpreted to be siltstone and mudstone. Silty fine sandstones also appear to be present. Correlation between the available well logs indicates that the sub-reservoir aquitard is laterally continuous; however, some lateral heterogeneity may also exist.

Because no laboratory measurements of the aquitard materials are available, both upper-bound and lower-bound vertical permeabilities were calculated for simulation purposes. For the upper-bound vertical permeability estimate, vertical permeability measurements from one representative Capay shale sample, as well as two samples of siltstone/sandstone from the upper “shaled out” portion of the reservoir at the Piacentine 2-27 core well, were used to calculate the harmonic average permeability, which gave an estimated vertical permeability value of 1.29 mD (Attachment G) for the upper-bound estimate. The lower-bound estimate of the vertical permeability is the harmonic mean of the horizontal permeabilities of 87 representative core samples in lower permeability sediments comprising the Capay Shale plus the upper

mostly shaled-out reservoir unit, which were than corrected to stress conditions using the average ratio of ambient to stress permeability and corrected to vertical permeability using the average vertical to horizontal permeability anisotropy ratio. The harmonic mean vertical permeability derived using this approach was 0.1 mD (Attachment G). These data gave an estimated vertical permeability value of 0.1 mD for the lower-bound estimate. Data from these samples and lithologies were selected because they were believed to be representative of the materials encountered in the base-of-reservoir aquitard and from interpretation of the logs for other wells in the King Island gas field. These vertical permeability estimates were also used for the other aquitards in the model.

To assess the impact of possible aquitard heterogeneity, two model sensitivity scenarios were developed with what are considered here to be extremely high aquitard vertical permeabilities. For these scenarios, the permeability of the sub-reservoir aquitard was increased to match the permeability of the underlying MR2 aquifer, as an extreme upper bound case (vertical permeability of 10 mD). Essentially, the vertical flow impedance between the reservoir and the Upper MR2 was eliminated, to test the impact of this extreme assumption.

Table A-2 and Figure A-4 show the seven permutations of aquifer parameters that were used to define five end-member cases for the modeling effort described herein:

1. Low Specific Storage (Sl) – The low specific storage assigned to the aquifer and aquitard units is the default value recommended in EPA guidance when specific information regarding this parameter is not available.[4] This value does not take into account the known increase in compressibility of the system resulting from the presence of trapped gas, or the increased compressibility of gas-saturated water; both factors, which if considered, would significantly raise the specific storage.
2. High Specific Storage (Sh) – An alternative higher specific storage value was calculated for Layer 1 to incorporate the compressibility of trapped gas known to exist in the water-invaded zone above the gas-water contact. Calculations are included in Attachment A-1. This scenario required calculation of a diminished water permeability resulting from the presence of trapped gas, as shown in Attachment A-1.
3. High Aquitard Vertical Permeability (Kh) – This is the higher of the two vertical permeability values that was calculated based on analysis of core samples collected from the Piacentine 2-27 core well. The high value resulted from taking the harmonic average of three vertical permeability measurements as described above.
4. Low Aquitard Vertical Permeability (Kl) – This is the lower of two vertical permeability values that was calculated based on a larger population of horizontal permeability data converted to vertical permeability at confining stress as described above.

[4] Engineering Enterprises, 1985.

5. Highest Vertical Permeability (Khh) – The highest permeability assumption assigns the same lateral and vertical permeability to the reservoir aquitard as is assigned to the underlying Upper MR2 aquifer, essentially simulating a system where the reservoir aquitard does not exist.

INITIAL CONDITIONS

Based on these five end-member cases, six model scenarios (ShKh, ShKl, SlKh, SlKl, ShKhh, and SlKhh) were developed to evaluate the impact of the expected ranges of parameters on the simulation results. Separate initial pressure distributions were established for each of the six model scenarios to simulate the upward pressure gradient present in the Mokelumne River Formation erosional remnant due to gas and water production from the reservoir. The initial pressure distributions were established iteratively in a two-step process by starting with steady-state simulations that had fixed pressures in the reservoir and at the Layer 9 general-head boundary. The steady-state pressure distributions were then used as initial conditions for subsequent transient simulations that were conducted for a specified period. The simulated pressure recovery rate in the reservoir was then compared to field data. The distance from the Layer 9 general-head boundary to the reservoir was adjusted iteratively until the simulated pressure recovery rate was reasonably calibrated to the pressure recovery rate observed in the field.

Initial pressures throughout the reservoir were considered uniform because bottomhole pressure measurements taken on February 12, 2014 (Table A-3) indicated that the lateral pressure gradient between the Piacentine 1-27 well (164 psi below hydrostatic) and the Citizen Green 1 well (158 psi below hydrostatic) is relatively flat. The initial pressure in the upper and lower reservoir layers were therefore set to the average of these two wells (161 psi below hydrostatic). The Layer 9 general-head boundary was set to 0 psi (i.e., hydrostatic pressure in the superposition model described herein).

The observed pressure increase at the Piacentine 1-27 well (Attachment A-4) from the beginning of January 2005 to the end of March 2006 was used to calibrate the simulated pressure recovery rate, because during this period no gas production occurred. The calculated bottomhole pressure increased from 1679.3 to 1724.7 psi (approximately 45 psi) during this 15-month period. It should be noted that the observed reservoir pressure during this period was lower than the currently observed reservoir pressure. Therefore, the resulting simulated pressure gradient can be expected to yield a more rapid rate of pressure increase than the currently observed pressure gradient. The calibration is therefore considered to be conservative for purposes of the modeling described herein.

For each of the six scenarios, the steady-state simulation generated a pressure distribution and gradient based on the average fixed pressures in the reservoir (-161 psi) and the Layer 9 general-head boundary (0 psi). This pressure gradient was then used as the initial condition for a 15-month transient simulation in which pressures in the reservoir and throughout the rest of the Mokelumne River Formation (except for the Layer 9 general-head boundary cells) evolved due to simulated groundwater flow. The location of the Layer 9 general-head boundary was adjusted until the upward pressure gradient between the boundary and the reservoir resulted in a simulated pressure recovery of 45 psi at the end of the 15-month period. The

simulated pressure changes in the reservoir, Upper MR2, Lower MR2, and MR3/MR4 during the 15-month calibration period for the six simulation scenarios are shown a series of graphs in Attachment A-1.

For the ShKhh scenario, the location of the Layer 9 general-head boundary is the same as the Kh scenarios boundary location. To meet the calibration target for the SlKhh scenario, it was necessary to increase the distance to the Layer 9 general-head boundary by 800 feet from the calibrated Kh scenarios boundary location. It is interesting to note that the baseline pressure curves used to develop the initial conditions for the reservoir and Upper MR2 are essentially identical. It is believed that these baseline pressure curves are less realistic than those for the Kh cases, which show a small pressure difference between these two model layers. This is especially true since the calibration target was established to match a time period when reservoir pressures were lower than they are currently, and the resulting baseline gradients are therefore likely to be over-estimated.

The calibrated pressure distributions were used as the initial conditions for each simulation scenario of pressure buildup during the compression test and subsequent pressure falloff for the year following the test.

INJECTION/WITHDRAWAL RATES

Representative injection and pumping (for flow testing) rates were assigned to each scenario by calculating equivalent water volumes (Attachment A-1). As discussed in Section A.3, the volume of pore water displaced by air injection is determined by the compressibility and pressure of the air bubble (which determines the volume it will occupy), and the compressibility and pressure exerted on the free gas cap remaining at the top of the reservoir (which determines the amount of reservoir space freed by gas compression). This information was used to calculate the total volume of pore water displaced by air injection for each modeling scenario, which was divided into injection and pumping rates for the compression testing phases based on the planned injection and flow activities. Additional detail regarding these calculations is presented in Attachment A-1.

Results

Mokelumne River Formation pressure buildup model results are presented in Attachment A-2 and include the following:

- Graph A-2a – Graphs showing simulated pressure buildup in the reservoir and Mokelumne River Formation aquifers at and beneath the Injection/Withdrawal well location for all six simulation scenarios (for a duration of 15 months).
- Graph A-2b – Graphs showing simulated pressure buildup at the Injection/Withdrawal well, the Piacentine 1-27, Piacentine 2-27, Citizen Green 1, and Moresco wells for the SlKl, ShKl, SlKh, and ShKh scenarios (for a duration of 450 days).
- Contour Plot A-2a – Contour plots of simulated pressure buildup and recovery for the ShKl and SlKl scenarios (for a maximum duration of 488 days).
- Contour Plot A-2b – Contour plots showing predicted pressure dissipation in the reservoir over time (for a maximum duration of 113 days).

The six simulation scenarios predict a short-term pressure increase that is most pronounced near the Injection/Withdrawal well and decreases with distance (Contour Plot A-2a in Attachment A-2). In each of these scenarios, the duration of simulated pressure increases above the normal hydrostatic gradient is predicted to be limited to the 90-day duration of the compression test and to fall off thereafter.

The most realistic conservative case among the six simulation scenarios is believed to be the ShKl scenario, because it honors what is known about the effect of trapped gas in the invaded aquifer zone above the original gas-water contact, while at the same time using the more conservative of the two aquitard permeability values. Under this scenario, the short-term pressure increase (above the ambient pressure) at the existing wells that penetrate the gas reservoir sands ranges from 175 psi (14 psi above the normal hydrostatic gradient) at the Moresco A-1, to 250 psi (89 psi above the normal hydrostatic gradient) at Piacentine 1-27 (Table A-4).[5] The ShKl case can be considered a reasonable conservative case to be relied upon for prediction of the maximum anticipated pressure increase in the reservoir.

The worst-case simulation results are from the SlKl scenario. This scenario is not believed to be realistic because the low specific storage scenarios (Sl) neglect the known increase in compressibility of the system resulting from the presence of trapped and free gas in the reservoir, and the increased compressibility of gas-saturated water; both factors, which if considered, would significantly raise the specific storage. When this is combined with the low permeability scenario (Kl), the combined effect of the two assumptions characterizes the SlKl scenario as a bounding case that represents a potential ceiling for pressure buildup in the reservoir during the compression test, but is not a reliable predictor of actual pressure buildup. The SlKl scenario is included for perspective on the upper bound of possible results. Under this scenario, the model predicts a short-term pressure increase ranging from 389 to 449 psi above ambient pressures at the Moresco A-1 and Piacentine 1-27 wells, respectively (228 to 288 psi above the normal hydrostatic gradient). The pressure build-up profiles for the SlKl cases for the AOR wells are provided in Attachment A-2, Graph A-2b.

The simulated pressure increases at the existing reservoir wells under the simulated ShKh and SlKh scenarios are less than the scenarios described above. Under the ShKh scenario, the normal hydrostatic gradient is predicted to be exceeded at the Piacentine 1-27 and 2-27 wells by approximately 42 and 15 psi, respectively. Under the SlKh scenario, the normal hydrostatic gradient is predicted to be exceeded at the Piacentine 1-27 and 2-27 wells by approximately 72 and 52 psi, respectively. Hydrostatic pressures are not predicted to be exceeded significantly at the Moresco A-1 or Citizen Green 1 wells for either of these simulation scenarios. The pressure build-up profiles for the ShKh and SIKh cases for the AOR wells are provided in Attachment A-2, Graph A-2b.

Contour plots of the simulated reservoir pressure relative to hydrostatic pressure for the ShKl and SlKl cases (see Contour Plot A-2a in Attachment A-2) show that a sharp cone of impression is expected to form around the Injection/Withdrawal well at the peak of the injection period after 44 days, with decreasing pressures toward the southwest portion of the reservoir. After 91 days (7 days after conclusion of the compression

[5] See Section A.5 for calculation of hydrostatic pressures at wells that penetrate the King Island reservoir sands.

test), pressures are predicted to have largely equalized across the reservoir, with a maximum pressure differential from southwest to northeast of approximately 7 psi for the ShKl case and approximately 1 psi for the SlKl case (Contour Plot A-2b in Attachment A-2). At 113 days (30 days after conclusion of the compression test), pressures are predicted to have equalized to a differential of less than 1 psi across the reservoir (Contour Plot A-2b in Attachment A-2). Rapid pressure equilibration throughout the reservoir is consistent with the relatively high permeability of the reservoir sediments. Higher pressures occur at these three times indices in the SlKl case than in the ShKl case. In addition, the rate of pressure change from one time index to the next is greater in the SlKl case than in the ShKl case.

Contour plot A-2a in Attachment A-2 provides the peak simulated pressures in the Upper MR2, Lower MR2, and MR3/MR4 aquifers for the ShKl and SlKl scenarios. As expected, these plots show that simulated pressures decreases with depth. Furthermore, the timing of the maximum simulated pressures is increasingly attenuated with depth.

The simulation results indicate that when the higher permeability (Khh) is paired with the high storativity case (Sh), pressure buildup in the Upper MR2 aquifer remains below the normal hydrostatic pressure (Graph A-2a in Attachment A-2). The ShKhh case includes the more realistic specific storage, but overestimates the aquitard vertical permeability, and therefore may also be considered a bounding case. When the higher permeability case (Khh) is paired with the lower storativity case (Sl), pressures increase above hydrostatic (maximum of 20 psi) for a short period of time (10 days) in the area surrounding the Injection/Withdrawal well, and then drops off rapidly (Graph A-2a in Attachment A-2). Both the specific storage and permeability used in the SlKhh sensitivity case are overly conservative, and this scenario was included only to gain perspective on the effect of uncertainty in these parameters.

Considering the SlKhh sensitivity scenario to be a worst case, with no pressure impedance between the reservoir and Upper MR2 aquifer, pressures would only build up to slightly above hydrostatic in the Upper MR2. However, an aquitard layer is present in reality, so some pressure impedance is to be expected. In addition, the known compressibility of trapped gas in the upper reservoir is neglected under this case. When the overly conservative assumptions for the modeling effort described herein are combined, the simulated pressure buildup is expected to be unrealistically high. Given that the predicted pressure buildup in the Upper MR2 under these extreme assumptions is only slightly higher than hydrostatic, we believe this evaluation demonstrates that pressure buildup in the Upper MR2 aquifer cannot reasonably be expected to exceed normal hydrostatic pressures during the compression test.

The model results will be validated once reservoir pressures and permeabilities are obtained from fall-off testing of the I/W well.

A.4.2 Case B - Simulation of Pressure Buildup in the Meganos Channel Fill

Modeling Code Selection

Modeling for this evaluation was performed using THWELLS, an analytical modeling code developed by the International Groundwater Modeling Center (IGWMC) of the Colorado School of Mines.[6] THWELLS is a two-dimensional analytical modeling code that calculates the drawdown or buildup of piezometric pressures resulting from up to 100 injection or withdrawal wells under confined, leaky confined or unconfined conditions. Calculations are performed based on the Theis equation for non-steady state flow in a uniform, isotropic and infinite confined aquifer, or the Hantush-Jacob equation for leaky confined aquifers under similar assumptions. The program allows designation of aquifer thickness, permeability, specific storage, pumping/injection rate and duration, simulation period and time steps. Impermeable boundaries may be simulated using image wells. Pressure calculations may be made for an areal grid of up to 100 by 100 user-defined nodes at a particular point in time, or for a designated point over a user-specified time period. THWELLS has been widely used for simulating the effects of pumping or injection wells for regulatory permits when a simplified modeling approach is appropriate. Simulation of injection directly into an aquifer underlying the King Island gas reservoir where pressures can propagate laterally is considered a conservative simplifying assumption that is an appropriate use of this modeling code.

Assumptions and Limitations

The UIC regulations specifically mentions the use of the Theis equation as an example for how to calculate the Zone of Endangering Influence that is the basis for establishing an AOR (40 CFR § 146.6(a)(2).) The Theis non-equilibrium well equation incorporates the following standard assumptions:

- The aquifer receiving injection is homogeneous and isotropic (addressed through conservative assumptions and sensitivity analysis);
- The aquifer is uniform in thickness (addressed through sensitivity analysis);
- The aquifer receives no recharge (reasonable for a deep confined aquifer);
- The injection well is completed in, and provides water to, the full thickness of the aquifer (conservative assumption);
- Water is provided to aquifer storage instantaneously when the pressure increases (reasonable at distance from the Injection/Withdrawal Well);
- The injection well is 100 percent efficient (reasonable since the model is not being used to predict well efficiency);
- Laminar flow exists throughout the well and aquifer (reasonable since the model is not being used to predict well efficiency); and
- The potentiometric surface has no slope (reasonable for a deep confined aquifer).

[6] Van der Heijde, PKM, 1996.

Conceptual Model and Approach

This evaluation assumes a lack (or local lack) of impermeable aquifer boundaries at the contact between the Mokelumne River Formation and the Meganos Channel fill below the King Island gas reservoir. The pressure in the aquifers underlying the King Island gas reservoir would increase as a result of vertical movement of water out of the gas reservoir, through the underlying lower permeability shale and siltstone, and into the underlying MR2, MR3 and MR4 aquifer sands. Pressure would then spread laterally past the contact between the Mokelumne River Formation and into aquifer sands of the Meganos Channel fill. Analysis of cores collected from a well drilled into gas-bearing Meganos Channel fill sands at the East Islands gas field, approximately 1¾ miles northwest of the proposed Injection/Withdrawal Well, indicates these sands are greater in permeability than the sands in the MR2 aquifer (Attachment G-2), which is consistent with their being re-worked sand from the Mokelumne River Formation. The average permeability of the MR2 and Meganos Chanel fill sands is therefore adopted for the model. Based on the assumption of unimpeded pressure propagation, the highest pressures may be expected close to the King Island erosional remnant and would decrease laterally away from the Injection/Withdrawal Well.

An additional consideration for this scenario is the potential effect of the normal fault mapped just south of the King Island gas reservoir on pressure buildup if it is a barrier to flow. The fault is mapped based on log data from the King Island 33-1 and Piacentine 1 wells (see Figure A-1, Figure F-12) and further described in Attachment G. Our conceptual model for pressure propagation through the Meganos Channel fill therefore includes separate scenarios for an infinite aquifer and for an aquifer with an impermeable boundary near where the fault has been mapped. In addition, sensitivity runs are included for two different aquifer thicknesses, since the thickness of the assumed sand-on-sand contact is unknown.

Model Inputs and Boundary Conditions

Pressure increase was evaluated by simulating injection into an infinite aquifer using THWELLS and representing a laterally continuous and combined aquifer consisting of connecting sands in the Mokelumne River Formation and the Meganos Channel fill. The aquifer model was run under four different scenarios:

- Scenario 1: Aquifer thickness of 50 feet with no impermeable boundaries;
- Scenario 2: Aquifer thickness of 50 feet with an impermeable boundary to the south at the approximate location of the normal fault;
- Scenario 3: Aquifer thickness of 100 feet with no impermeable boundaries; and
- Scenario 4: Aquifer thickness of 100 feet with an impermeable boundary to the south at the approximate location of the normal fault.

The assigned model boundary conditions and input parameters are summarized in Table A-5. Additional information regarding the derivation and rationale for these conditions and parameters is presented in Attachment A-3. The locations of the Injection/Withdrawal Well, impermeable boundary, and image well (to simulate the impermeable boundary) are shown on the Figures included in Attachment A-3.

Results

The model input and output files, as well as contour plots of the model outputs are included as Attachment A-3. The resulting pressure increase in feet of water was calculated and depicted on a 7-mile by 7-mile grid at the end of the injection period (90 days). Output results were contoured using Golden Software's Surfer and are presented in the attached figures. As expected, the greatest pressure increases are predicted to occur under scenarios that consider the fault south of the King Island gas reservoir to be an impermeable boundary, and for the scenarios that assume an aquifer thickness of 50 feet. Pressure increases near the edge of the King Island gas reservoir are as follows:

- Scenario 1 (50 foot thick aquifer, no fault boundary): approximately 35 to 70 psi near the edge of the reservoir, decreasing to approximately 20 to 25 psi at 1 mile from the reservoir;
- Scenario 2 (50 foot thick aquifer, with fault boundary): approximately 65 to 95 psi near the edge of the reservoir, decreasing to approximately 35 to 40 psi at 1 mile from the reservoir;
- Scenario 3 (100 foot thick aquifer, no fault boundary): approximately 20 to 40 psi near the edge of the reservoir, decreasing to approximately 15 psi or less at 1 mile from the reservoir; and
- Scenario 4 (100 foot thick aquifer, with fault boundary): approximately 40 to 55 psi near the edge of the reservoir, decreasing to approximately 25 psi or less at 1 mile from the reservoir.

These results are in general agreement with predicted pressure buildup (based on MODFLOW modeling) in the Upper MR2 aquifer sands, which range from approximately 40 to 150 psi (Attachment A-2).

A.5 AREA OF REVIEW

In order to establish the area of review, the predicted potential pressure buildup in the injection zone as a result of the compression test must be compared to pressures in the overlying USDW formations. The area of review is then defined as the areal extent of predicted pressure buildup that could drive out-of-injection-zone flow through artificial penetrations or natural conduits, if they exist and are capable of transmitting flow. As a conservative measure, it is assumed that the AOR encompasses the area where pressure differences between the injection zone and the AOR as a result of the injection well could drive flow through an unobstructed conduit or penetration, although such a conduit in reality is not expected to exist.

Existing Pressures in the Injection Zone

Information regarding pressures in the injection zone can be derived from historical production data and bottom-hole pressures (calculated from reported tubing head pressures) for the production wells in the King Island gas field, as well as from pressure measurements taken with Halliburton's Reservoir Description Tool (RDT™) during logging of the Piacentine 2-27 core well in March 2013. Graphs presenting gas production data, water production and calculated bottom-hole pressures for the Moresco, Piacentine 1-27 and Citizen Green wells are included in Attachment A-4. Details regarding the RDT™ testing program for the Piacentine 2-27 well are presented in Attachment G-1 and summarized in Table G-5.

Moresco et al. Unit A 1. The Moresco well was the discovery well for the King Island gas field, and had an initial bottom hole pressure of 2,080 psig prior to production in 1985. At that time, the Moresco well was perforated from 4,733 to 4,749 feet below ground surface, indicating a pressure gradient of 0.439 psi/foot (Table A-3). This value is believed to represent the normal hydrostatic gradient at the King Island gas field.[7] Pressures dropped steadily during early production but recovered when production was stopped for several months in late 1989/early 1990 due to water invasion. The well was re-perforated higher in the reservoir in January 1990, and pressures again dropped steadily until water invasion killed the well in 1995. Pressure measurements after production ceased are not available, and the well was plugged and abandoned in 1997.

Piacentine 1-27. This well was installed in 1986 and initial pressures were slightly below hydrostatic (2,020 psi at 4750-4764 feet; 0.425 psi/foot); however, the equilibration period prior to measurement was shorter than for the Moresco well and production from the field had already begun, so this measurement is not considered reliable (Attachment C-1). Pressures fell steadily during initial production, and then recovered and eventually became more erratic due to measurement errors resulting from water production. The well was re-perforated progressively higher in the reservoir several times, and produced much of the time between late 1989 and mid-2003 with intermittent water production. Production ceased between mid-2003 and mid-2006. Production was intermittent between Mid-2006 and December 2013, when the well was last shut-in. Since early 2005 pressure has steadily increased, and on June 2012 was 1,906 psi, approximately 114 psi below the initial pressure of 2,020 psi. On February 12, 2014, a bottom hole pressure of 1,883 psi was measured with a downhole pressure gauge, which is slightly less than the calculated bottom hole pressure of 1,906 psi in June 2012 and approximately 137 psi below the initial pressure of 2,020 psi. The pressure data is included in Attachment A-5, and is summarized in Table A-3. When not being produced or when production is very small, pressures have recovered at a rate of approximately 50 psi per year. (As noted below, production from the Citizen Green well since early 2013 should be causing current pressures to remain stable at a minimum.) This suggests that the King Island gas reservoir has a moderate water drive with an attenuated but consistent hydraulic connection with the underlying MR2 aquifer. The current slow but continuing recovery is consistent with a reservoir that has largely re-equilibrated with the underlying aquifer.

Citizen Green 1. This well was completed in December 2011 as a sidetrack well from the King Island 1-28 well, and has been producing attic gas from the western lobe of the King Island gas field. Initial pressures in this well were similar to the Piacentine 1-27, or approximately 1925 psi. On February 12, 2014, a bottom hole pressure of 1,898 psi was measured with a downhole pressure gauge. The pressure data is included in Attachment A-5, and summarized in Table A-3. Due to active production, the data from this well does not currently provide useful data regarding stabilized pressures in the gas field. Earlier production from the King Island 1-28 well occurred from an isolated gas pool in sands of the Meganos Channel fill that is not connected to the King Island gas field (Attachment G, Section G.5). Gas has been produced from this well at

[7] The normal hydrostatic gradient at depth is typically higher than the fresh water gradient of 0.433 psi/foot due to salinity, temperature and formation pressure effects (Guerard, 1984).

a rate of approximately 100 to 250 Mscfd since early 2013, which should be decreasing reservoir pressures slightly, or at a minimum keeping them stable.

RDT™ Log Data. Halliburton's RDT™ was used to collect pressure data from the Domengine Formation and Capay Shale, and from the Mokelumne River Formation in the reservoir sand and in the underlying aquifer sands of the MR2. The results are summarized in Table G-5 and indicate the pressures measured in the reservoir sands and the underling MR2 aquifer sands are consistently below the hydrostatic gradient and at a gradient of approximately 0.407 psi/foot. Pressures gradients in the MR2 sands are slightly higher, at 0.408 psi/foot. This is consistent with the above interpretation of the well production and pressure data. Pressure gradients in the overlying Domengine Formation are approximately 0.437 psi/foot, similar to the normal hydrostatic gradient reported for the Moresco well.

Based on the above data, the normal hydrostatic gradient for the King Island gas field is estimated to be 0.439 psi/foot. As such, current pressures in the reservoir sands are estimated to be at approximately 150 psi below hydrostatic. This equates to the following normal hydrostatic pressures at the existing wells that penetrate the gas reservoir sands:

TABLE A-6: CALCULATED HYDROSTATIC PRESSURES IN THE UPPERMOST MOKELUMNE RIVER FORMATION AT EXISTING KING ISLAND GAS FIELD WELLS

Well	Depth to Top of Mokelumne River Formation (feet) [1]	Current Pressure (psi) [2]	Normal Hydrostatic Pressure (psi) [3]
Piacentine 1-27	4,657	1,895	2,044
Piacentine 2-27	4,674	1,902	2,052
Citizen Green 1	4,688	1,908	2,058
Moresco et al. Unit A 1	4,684	1,906	2,056

1. Depths are feet below ground level calculated based on data presented in Tables C-1 and C-3.
2. Calculated by multiplying the depth to the top of the Mokelumne River Formation by the current pressure gradient of 0.407 psi/foot.
3. Calculated by multiplying the depth to the top of the Mokelumne River Formation by the normal hydrostatic gradient of 0.439 psi/foot.

Existing Pressures in USDW

As discussed in Attachment E, the lowermost USDW near the site occurs in the overlying Domengine Formation, about 700 feet above the Mokelumne River Formation. As shown in Table G-5, the pressure measured in the Domengine Formation during RDT™ logging of the Piacentine 2-27 well indicates pressures near hydrostatic in this formation with a gradient of 0.437 psi/foot. Water levels in the freshwater aquifers near the site are known to be within approximately 10 feet of the ground surface as discussed in Attachment E and shown on Figures E-2 and E-3. Because both underlying and overlying aquifers have pressures that are consistent with a hydrostatic gradient, it is reasonable to assume that the USDW formations in the area are also at hydrostatic pressures.

Determination of the Area of Review

Based on the available data (Table G-5 and Table A-6), the target injection zone in the Mokelumne River Formation is at least 150 psi below hydrostatic pressure; whereas, USDWs are believed to be at or near hydrostatic pressure. RDT™ pressure measurements in the MR2 reservoir sands that underlie the gas reservoir indicate that they are essentially in equilibrium with the reservoir sands. The Zone of Endangering Influence (ZEI) therefore conservatively encompasses those areas where pressures are predicted to increase by more than 150 psi as a result of the compression test.

The modeling results discussed in Section A.4.1 and presented in Attachment A-2 indicate that worst case predicted pressure buildup will exceed hydrostatic pressures throughout the gas reservoir sands, and this area should conservatively be considered part of the ZEI. However, it should be noted that the other three model scenarios predicted lower pressure buildups and the actual pressure buildup is expected to be less than that predicted by the worst case model scenario. Pressures in the Upper and Lower MR2 are predicted to remain below hydrostatic pressures under all scenarios evaluated.

Pressures in the Meganos Channel sands (if they are in communication with the aquifer sands) are conservatively predicted to increase by up to 95 psi under the worst case scenario (Section A.4.2 and Attachment A-3). These results are generally consistent with the maximum predicted pressure increase in the Upper MR2 sands. Therefore, based on the worst case modeling results, it is conservatively concluded that pressures laterally outside the Mokelumne River Formation will not exceed normal hydrostatic pressure, even if a sand-on-sand contact exists in the Upper or Lower MR2.

Based on the above evaluation, the ZEI comprises the reservoir sands and the northeastern portion of the MR2, where pressures are predicted to increase above hydrostatic pressures as a result of the compression test under the worst case evaluation scenario. EPA requires that the AOR encompass the ZEI and be a minimum of a ¼ mile radius around an injection well. The AOR is therefore defined as the boundary of the reservoir, plus a ¼ mile radius around the Injection/Withdrawal Well, as shown on Figure B-1.

A.6 References

Engineering Enterprises, 1985. Guidance Document for the Area of Review (AOR) Requirement.

Guerard, Bill, 1984. CDOGGR Publication M13, Evaluation and Surveillance of Water Injection Projects.

Harbaugh, Banta, Hill and McDonald, 2000. MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model User Guide to Modularization Concepts and the Ground-Water Flow Process: USGS Open File Report 00-92.

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Table A-1: Geologic Data for Mokelumne River Formation Model

Unit	Log Unit Thickness (feet) [1]				Model Layer Thickness (feet)	Comments
	Moresco	Citizen Green	Piacentine 1-27	Piacentine 2-27		
Reservoir Sand (net)	160	175	130	65	120	Model layer thickness represents weighted area average thickness across the entire reservoir footprint, including the edges.
Reservoir Base Aquitard	65	25	40	45	45	Model layer thickness represents average of four well logs rounded up to 45 feet.
Upper MR2 Sand (net)	60	45	55+	40+	55	Model layer thickness selected based on average between the Moresco and Citizen Green wells, rounded up to account for the minimum thickness in Piacentine 1-27.
Upper MR2 Basal Aquitard	40	35	--	--	40	Model layer thickness is higher of two values for conservatism.
Lower MR2 Sand (net)	185	177	--	--	180	Model layer thickness is average of two values rounded down to 180 feet.
Lower MR2 Basal Aquitard	70	60	--	--	65	Model layer thickness is average of two values.
MR3 and MR4 Sand (gross)	589	608			600	Model layer is average of two values rounded to nearest 100.
Lower MR4	300	300	--	--	200	Model layer thickness is approximate minimum laterally continuous thickness from Figure A-1.

Notes:

1. Net sand thicknesses and low permeability aquitard thickness for reservoir and MR2 based on interpretion of logs included in Attachment C-1.

Table A-2: Key Input Parameters for Mokelumne River Formation Model

Model Layer and Geologic Unit	Model Layer Thickness (feet)	Specific Storage		Horizontal Intrinsic Permeability		Vertical Intrinsic Permeability			Source of Permeability Data
		High Specific Storage Case (Sh) (1/ft)	Low Specific Storage Case (Sl) (1/ft)	High Specific Storage Case (Sh) (mD)	Low Specific Storage Case (Sl) (mD)	High Aquitard Perm Case (Kh) (mD)	Highest Aquitard Perm Case (Khh) (mD)	Low Aquitard Perm Case (Kl) (mD)	
Layer 1: Reservoir Sand above Original Gas-Water Contact (OGWC) (net)	40	9.8E-06 [1]	1.0E-06 [2]	448 [3]	807.0	1/10th of horizontal [4]	1/10th of horizontal [4]	1/10th of horizontal	Mean permeability data from 163 core analyses (Table G-1). Value for high Specific Storage Case (Sh) adjusted for relative permeability to account for partial gas saturation as described in Attachment .
Layer 2: Reservoir Sand below OGWC (net)	80	1.0E-06	1.0E-06	807.0	807.0	1/10th of horizontal	1/10th of horizontal	1/10th of horizontal	Mean permeability data from 163 core analyses (Table G-1)
Layer 3: Reservoir Base Aquitard	45	1.0E-06	1.0E-06	10x vertical [5]	10x vertical [5]	1.29	1/10th of Layer 4 horizonal	0.1	High Aquitard Vertical Permeability Case (Kh): Harmonic mean of vertical permeability of three representative core samples (Table G-3) Low Aquitard Vertical Permeability Case (Kl): Harmonic mean of horizontal permeability of 87 representative core samples adjusted using vertical-horzontal permeability relationship (Table G-3)
Layer 4: Upper MR2 Sand (net)	55	1.0E-06	1.0E-06	103	103	1/10th of horizontal	1/10th of horizontal	1/10th of horizontal	Derived from Citizen Green log calibrated to core analysis permeability-prosity cross plot (Table G-4)
Layer 5: Upper MR2 Basal Aquitard	40	1.0E-06	1.0E-06	10x vertical	10x vertical	1.29	1.29	0.1	Same as Reservoir Base Aquitard
Layer 6: Lower MR2 Sand (net)	180	1.0E-06	1.0E-06	632	632	1/10th of horizontal	1/10th of horizontal	1/10th of horizontal	Derived from Citizen Green log calibrated to core analysis permeability-prosity cross plot (Table G-4)
Layer 7: Lower MR2 Basal Aquitard	65	1.0E-06	1.0E-06	10x vertical	10x vertical	1.29	1.29	0.1	Same as Reservoir Base Aquitard
Layer 8: MR3 and MR4 Sand (gross)	600	1.0E-06	1.0E-06	10	10	1.29	1.29	1/10th of horizontal	Derived from Citizen Green log calibrated to core analysis permeability-prosity cross plot (Table G-4)
Layer 9: Lower MR4	200	1.0E-06	1.0E-06	10x vertical	10x vertical	1.29	1.29	0.1	Same as Reservoir Base Aquitard

Notes:

1. High specific storage case applies to the upper reservoir above the original gas-water contact (Model Layer 1) and includes the compressibility of native gas trapped in the pore space of the water-invaded zone. Calculations are presented in Attachment A-1.

2. The assigned specific storage is the default value recommended under EPA guidance when specific information is not available (Engineering Enterprises, 1985).

3. Permeability of the upper reservoir above the original gas-water contact is diminished due to the presence of trapped gas. Calculations are presented in Attachment A-1.

4. A default anistropy ratio of 10:1 (horizontal:vertical) has been applied throughout the model to account for vertical heterogeneity.

5. For the two Khh cases, the horizontal intrinsic permeability is 103 mD (i.e., equal to the Layer 4 values)

Table A-3
Summary of Depth Discrete Pressure Data
Proposed PG&E Compressed Air Energy Storage Project Injection/Withdrawal Test Well

Date	Formation Zone	Location	Depth [1]	Measured Pressure (psia)	Measured Pressure (psig)[2]	Pressure Gradient at time of Measurement (psi/ft) [3]	Pressure Deviation from Normal Hydrostatic Gradient (psi) [4]
7-Oct-85	King Island Gas Reservoir	Pre-production measurement at Moresco et al. Unit A 1 [5]	4741	--	2080	0.439	0.0
25-Mar-13	Domengine Sand	Piacentine 2-27 RDT™ Measurement [6]	4618	2021.65	2006.95	0.435	-20.4
	King Island Gas Reservoir		4683	1908.98	1894.28	0.405	-161.6
			4708	1920.06	1905.36	0.405	-161.5
			4742	1934.5	1919.8	0.405	-161.9
			4750	1937.94	1923.24	0.405	-162.0
			4762	1943.78	1929.08	0.405	-161.4
			4762	1943.08	1928.38	0.405	-162.1
			4776	1949.21	1934.51	0.405	-162.2
			4781	1951.75	1937.05	0.405	-161.8
			4792	1956.14	1941.44	0.405	-162.2
			4798	1958.78	1944.08	0.405	-162.2
	Upper MR2 Aquifer		4868	1989.77	1975.07	0.406	-162.0
			4878	1994.05	1979.35	0.406	-162.1
12-Feb-14	King Island Gas Reservoir	Citizen Green 1 BHP [7]	4684	--	1897.55	0.405	-158.7
		Piacentine 1-27 BHP [7]	4663.5	--	1883.3	0.404	-164.0

Notes:

(1) Vertical depth below ground surface has been computed from feet below Kelly Bushing. For wells, the midpoint of the screen interval is used.

(2) Pressure in psig is either measured directly, or, in the cast of RDT measurement, converted from psia by subtracting 14.7 psi.

(3) Pressure gradient calculated by dividing pressure in psig by the depth of the measurement

(4) Normal hydrostatic gradient is 0.439 psi/foot based on discovery pressure measured in Moresco et al. Unit A 1.

(5) Calculated from a shut in tubing pressure of 1870 psi at the end of a 12-hour pressure buildup test.

(6) Pressure measurements taken using RDT™. See Attachment C-1 to the Underground Injection Control Permit Application dated January 3, 2014 for complete report.

(7) Bottom hole pressure measured using a wireline pressure gauge as described in Attachment 1. Prior to measurements, Piacentine 1-27 shut-in for 42 days and Citizen Green 1 shut-in for 49 hours.

psia = pounds per square inch - absolute

psig = pounds per square inch - gauge

psi = pounds per square inch

RDT™ = Halliburton Reservoir Description Tool

BHP = Bottomhole pressure

Table A-4
Maximum Predicted Pressure Buildup in King Island Gas Field Wells
Reasonable Conservative Case (ShKl)
Proposed PG&E Compressed Air Energy Storage Project Injection/Withdrawal Test Well

Well Name	Penetrated Model Layer with Maximum Predicted Pressure Shown (psi relative to normal hydrostatic pressure)			
	Reservoir	Upper MR2	Lower MR2	MR3/MR4
Piacentine 1-27	89	--	--	--
Piacentine 2-27	67	--	--	--
Citizen Green 1	17	--	--	--
Moresco et al. Unit A 1	14	--	--	--
King Island 33-1	--	-68	--	--
Piacentine 1	--	-68	--	--
Klein 1-28	--	--	-79	--
King Island 1-28	--	--	--	-90

Notes:
-- indicates layer not penetrated or peak pressure relative to hydrostatic does not occur in this layer

Table A-5: Key Input Parameters for Combined Mokelumne River Formation - Meganos Channel Fill Model

		Storage Coefficient		Transmissivity				
Scenario	Boundaries	Specific Storage (1/foot)	Storativity	Aquifer Thickness (feet)	Intrinsic Permeability (mD)	Transmissivity (gpd/foot)	Injection Rate (gpd)	Comments
1	Infinte aquifer	1.0E-06 (1)	5.0E-05 (2)	50	835 (3)	850 (4)	257,895 (5)	Aquifer thickness is not a direct model input, but is incorporated into the calculation of transmissivity. Therefore, running cased with multiple aquifer thicknesses serves as a sensitivity analysis on aquifer thickness and permeability.
2	Fault boundary modeled with image well	1.0E-06	5.0E-05	50	835	850	257,895	
3	Infinte aquifer	1.0E-06	5.0E-05	100	835	1,701	257,895	From log interpretation, sand packages in the Meganos Channel Fill tend to be thinner than sands in the Mokelumne River Formation, thus 50 to 100 feet is selected as a reasonable range.
4	Fault boundary modeled with image well	1.0E-06	5.0E-05	100	835	1,701	257,895	Permeability data for the Meganos Channel Fill sands is averaged with permeability data for the Upper and Lower MR2. Values are 1,771, 103 and 632 mD, respectively.

Notes:

mD = millidarcies

gpd = gallons per day

1. The assigned specific storage is the default value recommended under EPA guidance when specific information is not available (Engineering Enterprises, 1985).
2. Derived by multiplying specific storage by the aquifer thickness.
3. Average of Upper MR2, Lower MR2 and Meganos Channel Fill sand permeabilities (Table G-4 and Attachment G-2).
4. Derived by the following equation: (Permeability in mD) x (1 D/1,000 mD) x ((2.73 feet/day)/D) x ((7.46 gpd)/(1 foot/day)) x (Aquifer thickness in feet)
5. Average injection rate in gpd if the maximum displaced water volume calculated in Section A.3 is injected over 76 days of the compression test during which injection or withdrawal occurs.

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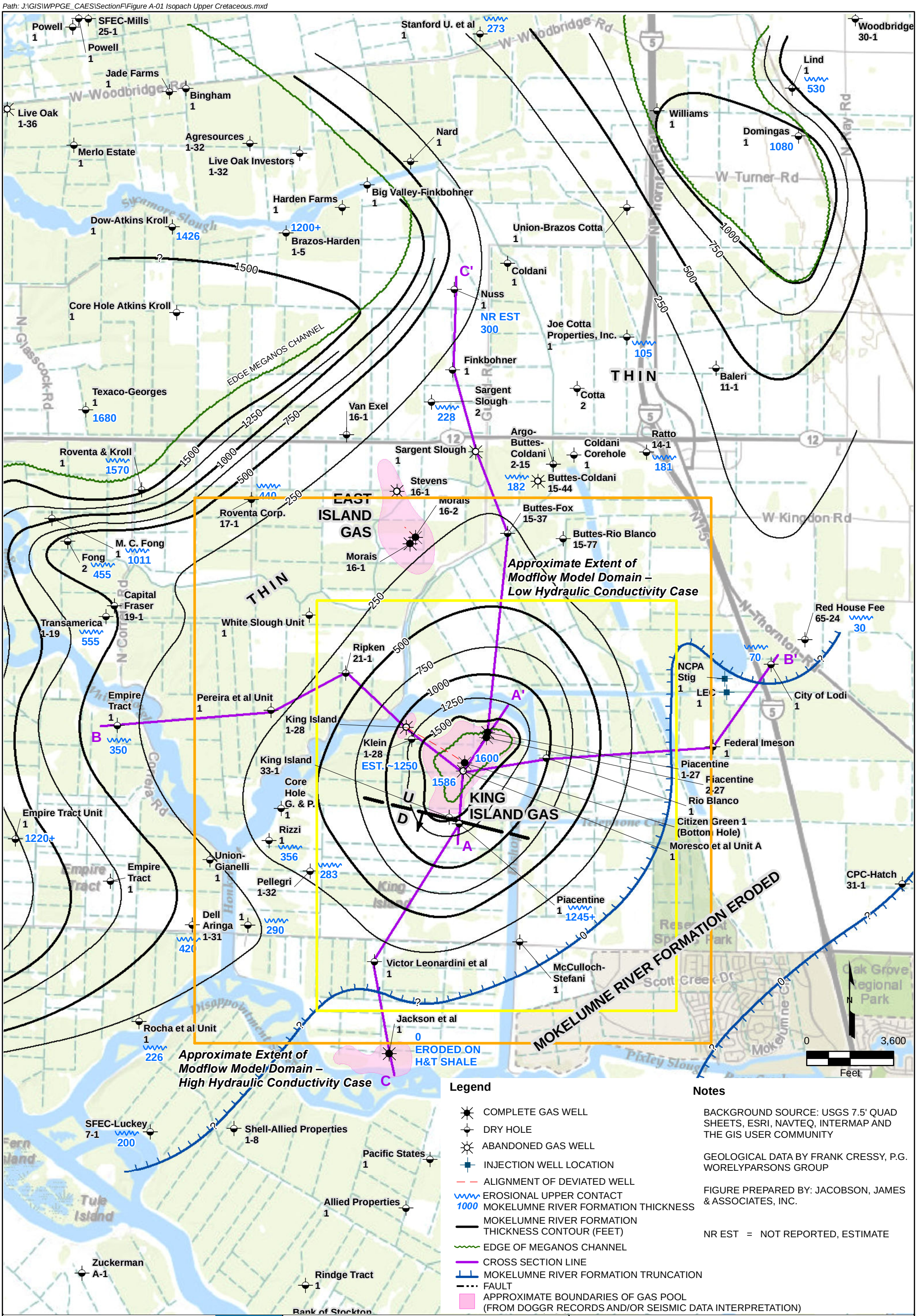

Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- EROSIONAL UPPER CONTACT
- 1000 MOKELUMNE RIVER FORMATION THICKNESS
- MOKELUMNE RIVER FORMATION THICKNESS CONTOUR (FEET)
- EDGE OF MEGANOS CHANNEL
- CROSS SECTION LINE
- MOKELUMNE RIVER FORMATION TRUNCATION
- FAULT
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

NR EST = NOT REPORTED, ESTIMATE

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

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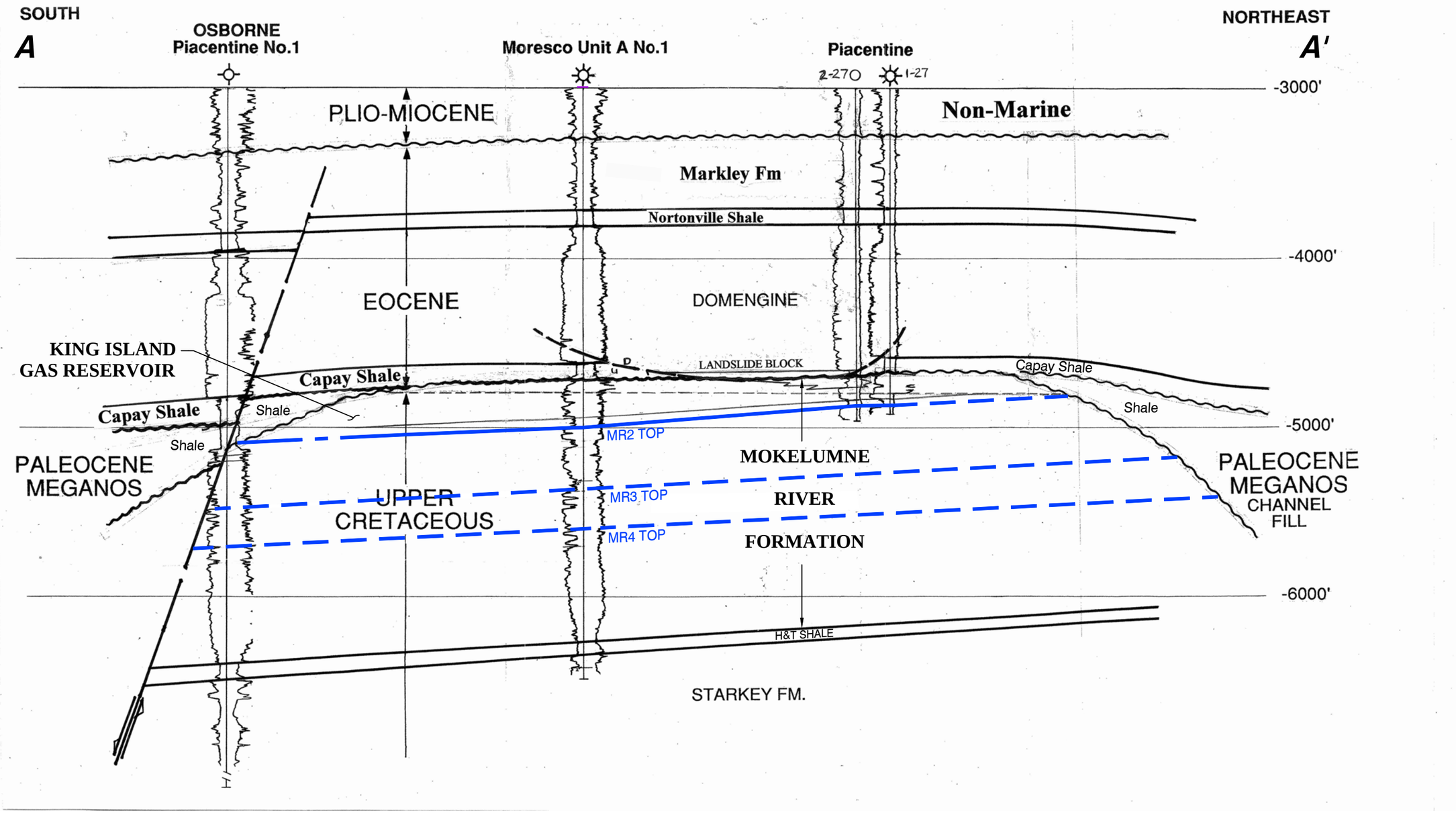
FIGURE A-1

ISOPACH MAP: UPPER CRETACEOUS MOKELUMNE RIVER FORMATION



NOTES:

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP
TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

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FIGURE A-2

STRUCTURE SECTION A-A'

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Well	MR2	MR3	MR4	base MR4*
Piacentine 1-27	(-4848)	NR	NR	NR
Piacentine 2-27	(-4852')	NR	NR	NR
Moresco	(-4995')	(-5377')	(-5678')	(-5992')
Citizen Green	(-4997')	(-5385')	(-5681')	(-6008')
Piacentine 1-33	(-5042')**	(-5423')	(-5752')	(-6040')
King Island 1-33	(-5038')	(-5437')	NR	NR

* Base MR4 based on permeability loss at 6650' MD in Citizen Green Well
** Estimated, point eroded or faulted

Morais 16-1
White Slough Unit 1
Ripken 21-1
KING ISLAND 1-28
Klein 1-28
Piacentine 1-27
Piacentine 2-27
Citizen Green 1 (Bottom Hole)
Moresco et al Unit A 1
Rio Blanco 1
King Island 33-1
MR2
MR3
MR4
Piacentine 1
pellegri 1-32
APPROXIMATE BASE PERMEABLE MR4
RESERVOIR SAND SUBCROP AREA = 229.22 ACRES
LOWER MR2 SAND SUBCROP AREA = 564.85 ACRES
UPPER MR2 SAND SUBCROP AREA = 334.49 ACRES
McCulloch-Stefani 1
Victor Leonardini et al 1
N
0 0.25 Miles

Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- ALIGNMENT OF DEVIATED WELL
- MOKELUMNE RIVER FORMATION MARKER SUBCROP

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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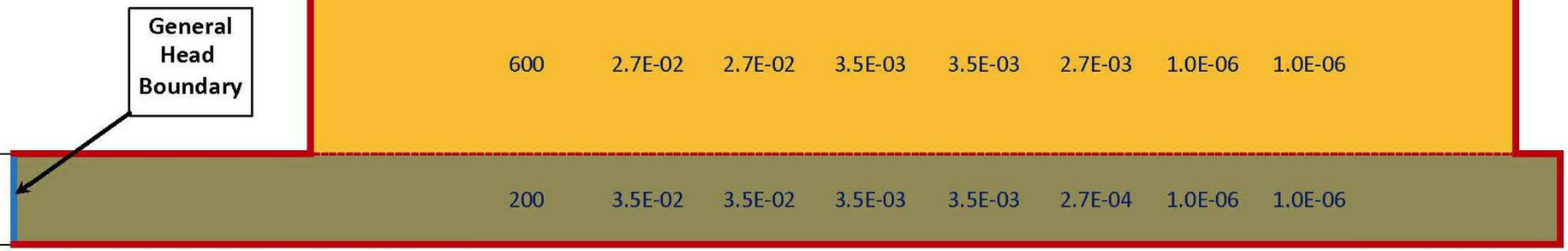
FIGURE A-3

APPROXIMATE SUBCROP/TRUNCATIONS OF MR ZONES BY MEGANOS CHANNEL

Model Layer	Description	Layer Thickness (ft)	Case Sh K_h (ft/day)	Case Sl K_h (ft/day)	Case Kh K_v (ft/day)	Case Khh K_v (ft/day)	Case Kl K_v (ft/day)	Case Sh S_s (1/ft)	Case Sl S_s (1/ft)
1	Reservoir Sand above OGWC	40	1.2	2.2	0.12	0.12	0.22	9.8E-05	1.0E-06
2	Reservoir Sand below OGWC	80	2.2	2.2	0.22	0.22	0.22	1.0E-06	1.0E-06
3	Base Reservoir Aquitard	45	3.5E-02	3.5E-02	3.5E-03	2.7E-02	2.7E-04	1.0E-06	1.0E-06
4	Upper MR2 Sand	55	0.27	0.27	2.7E-02	2.7E-02	2.7E-02	1.0E-06	1.0E-06
5	Aquitard	40	3.5E-02	3.5E-02	3.5E-03	3.5E-03	2.7E-04	1.0E-06	1.0E-06
6	Lower MR2 Sand	180	1.7	1.7	0.17	0.17	0.17	1.0E-06	1.0E-06
7	Aquitard	65	3.5E-02	3.5E-02	3.5E-03	3.5E-03	2.7E-04	1.0E-06	1.0E-06
8	Permeable MR3/MR4	600	2.7E-02	2.7E-02	3.5E-03	3.5E-03	2.7E-03	1.0E-06	1.0E-06
9	Lower MR4 Aquitard	200	3.5E-02	3.5E-02	3.5E-03	3.5E-03	2.7E-04	1.0E-06	1.0E-06



Notes:

Kh = Horizontal hydraulic conductivity. Calculated from intrinsic permeabilty by the conversion factor 1 Darcy = 2.73 feet/day

Kv = Vertical hydraulic conductivity. Calculated from intrinsic permeabilty by the conversion factor 1 Darcy = 2.73 feet/day

OGWC = Original gas-water contact. An average of 40 feet of net sand occur above the original gas water contact based on log interpretation and 3-D seismic data interpretation.

NOTE:

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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FIGURE A-4

MRF MODEL OVERVIEW

J: \GIS\WPPGE_CAES\SectionF\Figure A-04 MRF Model Overview.dwg

ATTACHMENT A-1

Mokelumne River Formation Pressure Buildup Model Calculations and MODFLOW Inputs

Attachment A-1: MODFLOW Model Implementation: Inputs, Aquifer Parameters, Boundary Conditions, and Initial Conditions

Pressure increase was evaluated by simulating injection into a multi-layer model constructed in MODFLOW 2000 using the Groundwater Vistas platform to simulate water flow and pressure propagation vertically downward and laterally outward through a sequence of aquifers and aquitards that represents the general geometry and properties of the Mokelumne River Formation erosional remnant at King Island. The compression test was simulated by injection of an amount of water equivalent to the pore water displaced by air injection into the upper portion of the water-invaded gas reservoir. Flow testing was simulated as water withdrawal. Modeling was performed using a superposition approach; that is, the outputs reflect only the contribution of changes resulting from the compression test.

Two separate model domains were established, both of which were centered approximately on the King Island gas field. The domains were established for high (Kh) and low (Kl) hydraulic conductivity cases defined for the sensitivity runs, as discussed below. A grid-cell size of 200 by 200 feet was used throughout most of the domains, except near the injection point, where the cell size was reduced to 10 feet by 10 feet to allow better resolution. These model domains are illustrated on Figure A-1. The geologic basis for the model design is summarized in Table A-1. The model was built using nine layers to simulate four generalized aquifer units and four aquitard sequences as shown on Table A-2. The uppermost layer, representing the reservoir sands, was subdivided into two layers to represent the net sand above and below the original gas-water contact.

No-flow boundaries were established for the upper eight layers at the respective subcrop boundaries (Figure A-3). For the ninth layer, no-flow boundaries were established to the south and east, where the Meganos Channel truncates the Mokelumne River Formation (Figure A-1). General-head boundaries were established at the edge of Layer 9 at the remaining locations, which were set to 0 psi (i.e., hydrostatic pressure in the superposition model described herein).

The thicknesses and properties assigned to each layer are summarized in Table A-1, Table A-2, and on Figure A-4. Two key input parameters span a significant range depending on how they are calculated: (1) the specific storage of the water-invaded sands above the original gas-water contact and (2) the vertical permeabilities of the aquitards. The remaining properties are considered to be relatively well-constrained by the available data.

No laboratory vertical permeability measurements of the aquitard materials between the reservoir and Upper MR2 are available. Well-log interpretation indicates that the aquitard is vertically heterogeneous and contains a significant amount of shale and other low permeability materials interpreted to be siltstone and mudstone. Silty fine sandstones also appear to be present. Correlation between the available well logs indicates that the sub-reservoir aquitard is laterally continuous; however, some lateral heterogeneity may also exist.

Because no laboratory measurements of the aquitard materials are available, both upper-bound and lower-bound vertical permeabilities were calculated for simulation purposes. For the upper-bound vertical

permeability estimate, vertical permeability measurements from one representative Capay shale sample, as well as two samples of siltstone/sandstone from the upper "shaled out" portion of the reservoir at the Piacentine 2-27 core well, were used to calculate the harmonic average permeability, which gave an estimated vertical permeability value of 1.29 mD (Attachment G) for the upper-bound estimate. The lower-bound estimate of the vertical permeability is the harmonic mean of the horizontal permeabilities of 87 representative core samples in lower permeability sediments comprising the Capay Shale plus the upper mostly shaled-out reservoir unit, which were than corrected to stress conditions using the average ratio of ambient to stress permeability and corrected to vertical permeability using the average vertical to horizontal permeability anisotropy ratio. The estimated vertical permeability derived using this approach was 0.1 mD (Attachment G), which represents the lower-bound estimate. Data from these samples and lithologies were selected because they were believed to be representative of the materials encountered in the base-of-reservoir aquitard and from interpretation of the logs for other wells in the King Island Gas Field. These vertical permeability estimates were also used for the other aquitards in the model.

To assess the impact of possible aquitard heterogeneity, two model sensitivity scenarios were developed with what are considered here to be extremely high aquitard vertical permeabilities. For these scenarios, the permeability of the sub-reservoir aquitard was increased to match the permeability of the underlying MR2 aquifer, as an extreme upper bound case (vertical permeability of 10 mD). Essentially, the vertical flow impedance between the reservoir and the Upper MR2 was eliminated, to test the impact of this extreme assumption. Table A-2 and Figure A-4 show the seven permutations of aquifer parameters that were used to define five end-member cases for the modeling effort described herein:

1. Low Specific Storage (Sl) – The low specific storage assigned to the aquifer and aquitard units is the default value recommended in EPA guidance when specific information regarding this parameter is not available[1]. This value does not take into account the known increase in compressibility of the system resulting from the presence of trapped gas, or the increased compressibility of gas-saturated water; both factors, which if considered, would significantly raise the specific storage.
2. High Specific Storage (Sh) – An alternative higher specific storage value was calculated for Layer 1 to incorporate the compressibility of trapped gas known to exist in the water-invaded zone above the gas-water contact. Calculations are included in the spreadsheets provided at the end of this Attachment. This scenario required calculation of a diminished water permeability resulting from the presence of trapped gas, as shown in the spreadsheets provided in this Attachment.
3. High Aquitard Vertical Permeability (Kh) – This is the higher of the two vertical permeability values that was calculated based on analysis of core samples collected from the Piacentine 2-27 core well. The high value resulted from taking the harmonic average of three vertical permeability measurements as described above.
4. Low Aquitard Vertical Permeability (Kl) – This is the lower of two vertical permeability values that was calculated based on a larger population of horizontal permeability data converted to vertical permeability at confining stress as described above.

[1] Engineering Enterprises, 1985. Guidance Document for the Area of Review (AOR) Requirement.

5. Highest Vertical Permeability (Khh) – The highest permeability assumption assigns the same lateral and vertical permeability to the reservoir aquitard as is assigned to the underlying Upper MR2 aquifer, essentially simulating a system where the reservoir aquitard does not exist.

Based on these five end-member cases, six model scenarios (ShKh, ShKl, SlKh, SlKl, ShKhh, and SlKhh) were developed to evaluate the impact of the expected ranges of parameters on the simulation results. Separate initial pressure distributions were established for each of the six model scenarios to simulate the upward pressure gradient present in the Mokelumne River Formation erosional remnant due to gas and water production from the reservoir. The initial pressure distributions were established iteratively in a two-step process by starting with steady-state simulations that had fixed pressures in the reservoir and at the Layer 9 general-head boundary. The steady-state pressure distributions were then used as initial conditions for subsequent transient simulations that were conducted for a specified period. The simulated pressure recovery rate in the reservoir was then compared to field data. The distance from the Layer 9 general-head boundary to the reservoir was adjusted iteratively until the simulated pressure recovery rate was reasonably calibrated to the pressure recovery rate observed in the field.

Initial pressures throughout the reservoir were considered uniform because bottomhole pressure measurements taken on February 12, 2014 (Table A-3) indicated that the lateral pressure gradient between the Piacentine 1-27 well (164 psi below hydrostatic) and the Citizen Green 1 well (158.7 psi below hydrostatic) is relatively flat. The initial pressure in the upper and lower reservoir layers were therefore set to the average of these two wells (161 psi below hydrostatic). The Layer 9 general-head boundary was set to 0 psi (i.e., hydrostatic pressure in the superposition model described herein).

The observed pressure increase at the Piacentine 1-27 well (Attachment A-4) from the beginning of January 2005 to the end of March 2006 was used to calibrate the simulated pressure recovery rate, because during this period no gas production occurred. The calculated bottomhole pressure increased from 1679.3 to 1724.7 psi (approximately 45 psi) during this 15-month period. It should be noted that the observed reservoir pressure during this period was lower than the currently observed reservoir pressure. Therefore, the resulting simulated pressure gradient can be expected to yield a more rapid rate of pressure increase than the currently observed pressure gradient. The calibration is therefore considered to be conservative for purposes of the modeling described herein.

For each of the six scenarios, the steady-state simulation generated a pressure distribution and gradient based on the average fixed pressures in the reservoir (-161 psi) and the Layer 9 general-head boundary (0 psi). This pressure gradient was then used as the initial condition for a 15-month transient simulation in which pressures in the reservoir and throughout the rest of the Mokelumne River Formation (except for the Layer 9 general-head boundary cells) evolved due to simulated groundwater flow. The location of the Layer 9 general-head boundary was adjusted until the upward pressure gradient between the boundary and the reservoir resulted in a simulated pressure recovery of 45 psi at the end of the 15-month period. The simulated pressure changes in the reservoir, Upper MR2, Lower MR2, and MR3/MR4 during the 15-month calibration period for the six simulation scenarios are shown in the series of graphs provided below.

For the ShKhh scenario, the location of the Layer 9 general-head boundary is the same as the Kh scenarios boundary location. To meet the calibration target for the SlKhh scenario, it was necessary to increase the distance to the Layer 9 general-head boundary by 800 feet from the calibrated Kh scenarios boundary location. It is interesting to note that the baseline pressure curves used to develop the initial conditions for the reservoir and Upper MR2 are essentially identical. It is believed that these baseline pressure curves are less realistic than those for the Kh cases, which show a small pressure difference between these two model layers. This is especially true since the calibration target was established to match a time period when reservoir pressures were lower than they are currently, and the resulting baseline gradients are therefore likely to be over-estimated.

The calibrated pressure distributions were used as the initial conditions for each simulation scenario of pressure buildup during the compression test and subsequent pressure falloff for the year following the test.

Documentation of the following additional input calculations is attached:

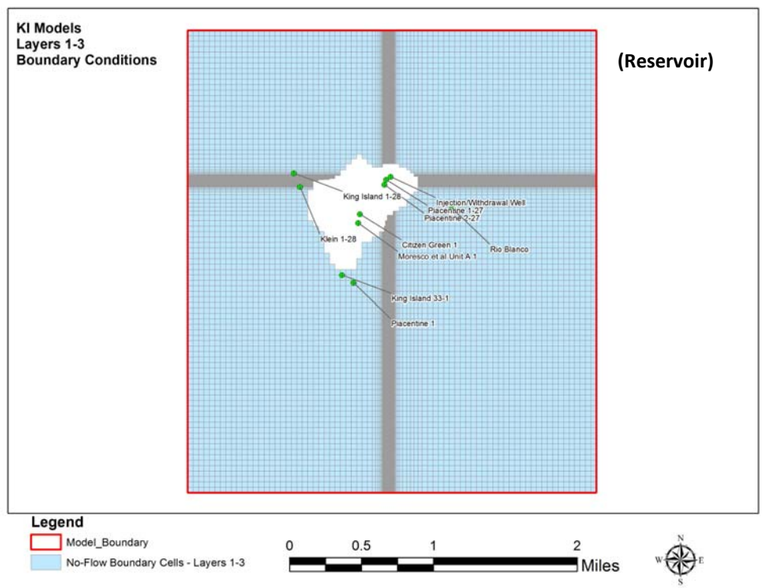
- Injection/Pumping Rate: The total volume of water displaced by air injection at the maximum bubble size was calculated using the method described in Attachment A, Section A.3. To calculate specific injection or pumping rates, the compression test was divided into four periods, including the initial bubble building period, the initial test period, and optional air injection period, and the optional air withdrawal testing period. The net volume of air injected or withdrawn during each period was then divided by the maximum air bubble size, multiplied by the total displaced formation water volume and divided the duration of the period to calculate a pumping or injection rate.

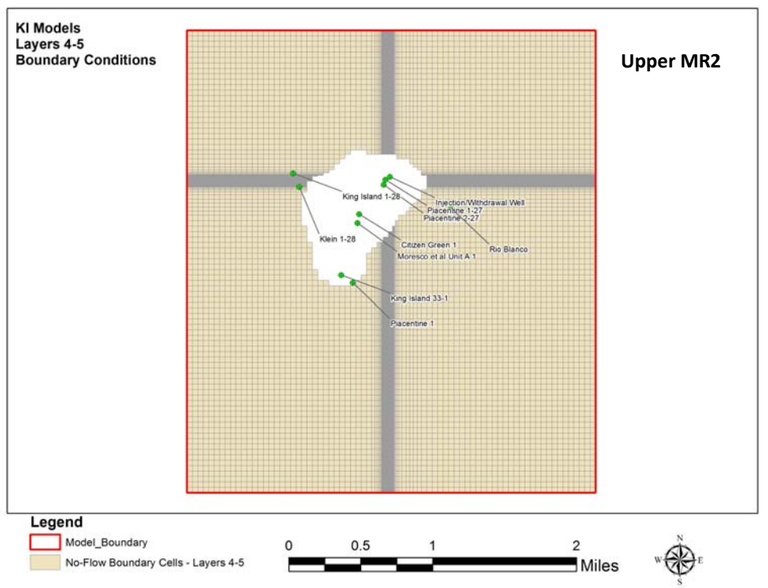
- Specific Storage: Specific storage was calculated as the sum of total compressibility of the formation, water, and the trapped gas in accordance with the method described in the *Handbook of Petroleum Engineering*, published by the Society of Petroleum Engineers in 1987, Howard B. Bradley, editor.

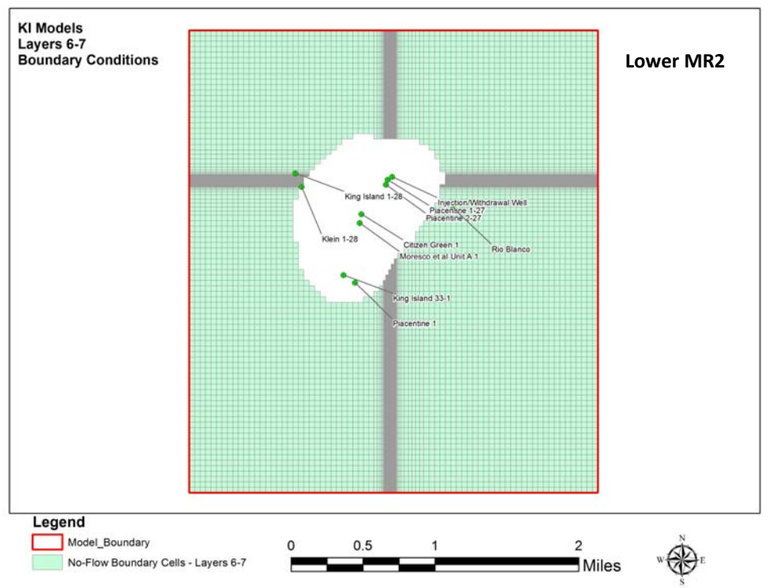
- Trapped Gas Saturation: A volumetric approach was taken to calculate the trapped gas saturation above the original gas-water contact. The average net sand thickness above the original gas-water contact was estimated to be 40 feet based on log interpretation and reservoir structural data. The amount of trapped gas was estimated to be 2.5 BCF based on an estimated amount of remaining free gas of 1 BCF based on data regarding the gas-water contact in the Citizen Green well and data from Piacentine 1-27, an estimate of original gas in place of 14 BCF, of 10.5 BCF. An average reservoir porosity of 30% was assumed.

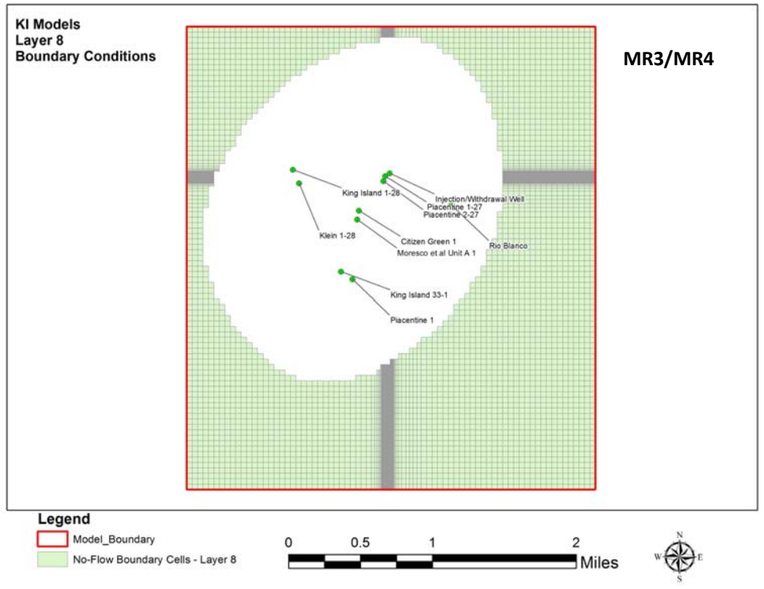
- Relative Permeability to Water in the Water Invaded Zone: The reservoir permeability to water above the original gas-water contact is expected to be diminished by the presence of trapped gas bubbles. The effective permeability to water was calculated using the method described in Bras, Rafael, 1990, *Hydrology*. A gas saturation of 16% and a pore disconnectedness index consistent with sand were used.

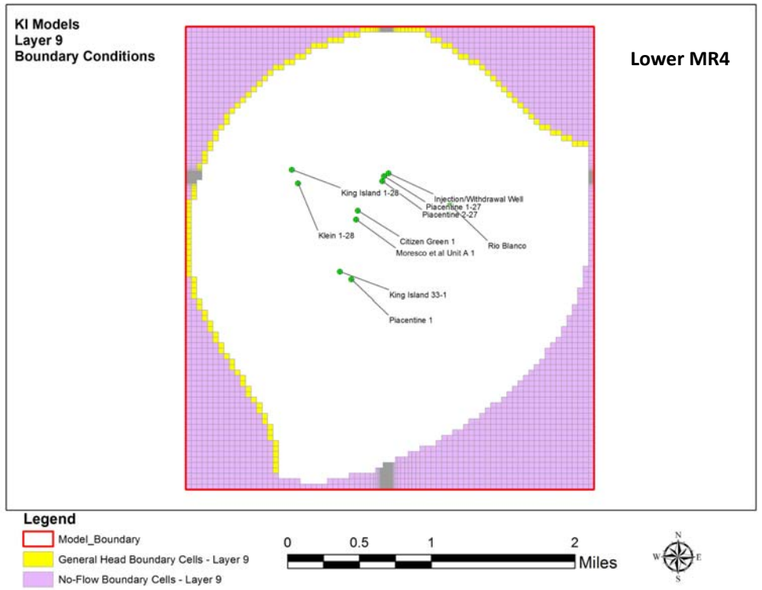
Model Boundary Conditions for KI Case Models



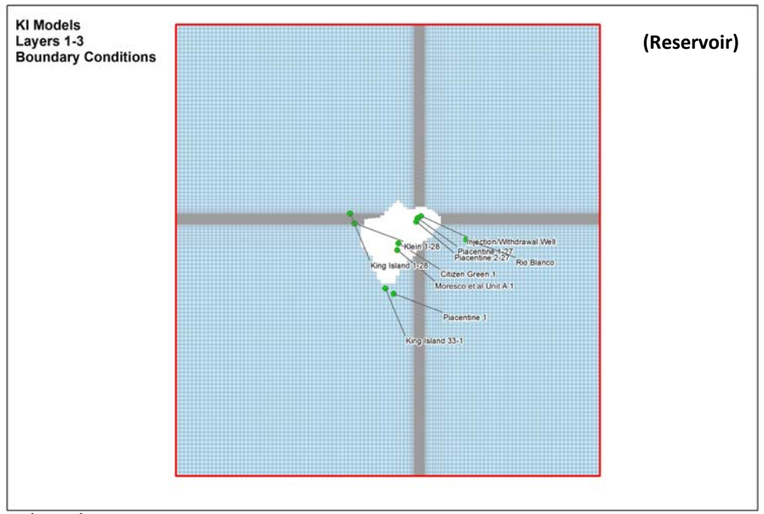


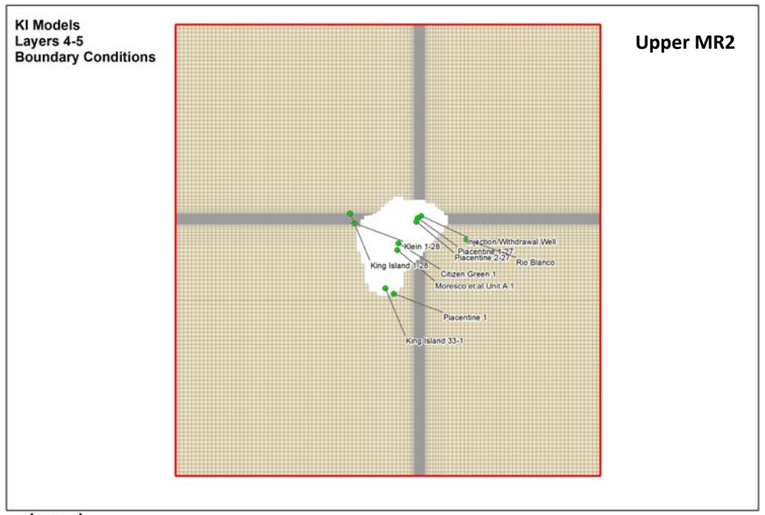




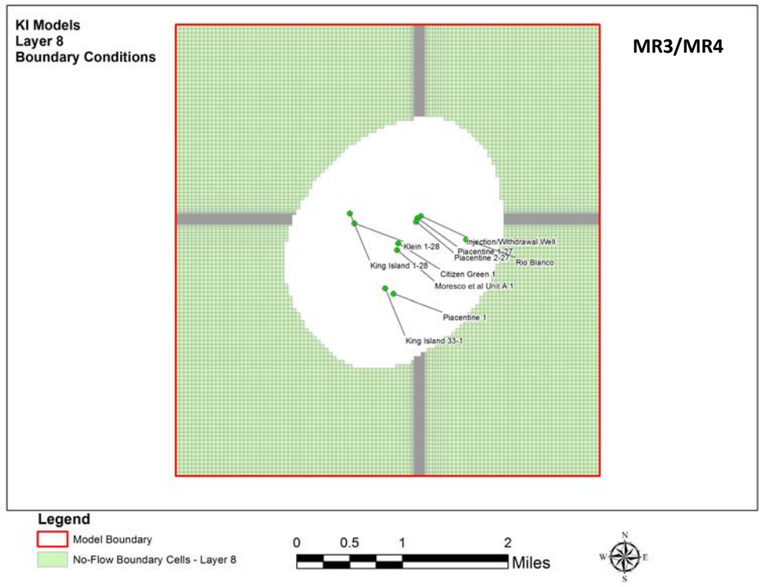


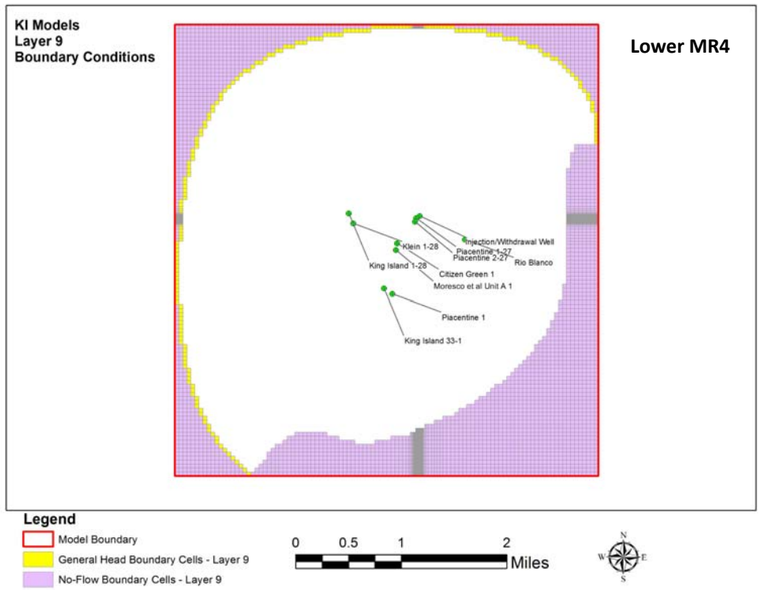
Model Boundary Conditions for Kh Case Models



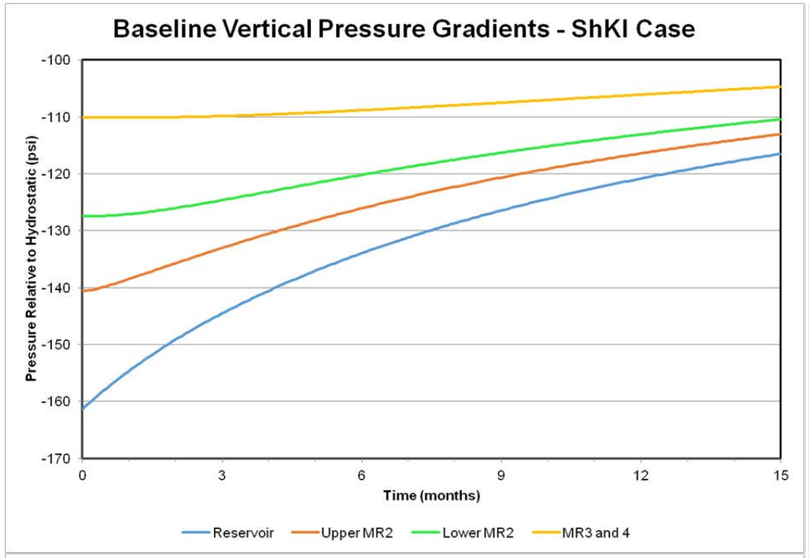


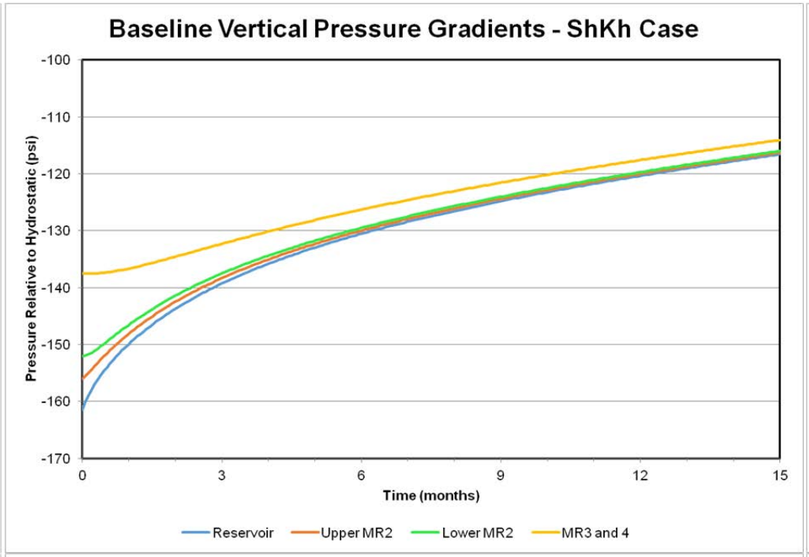


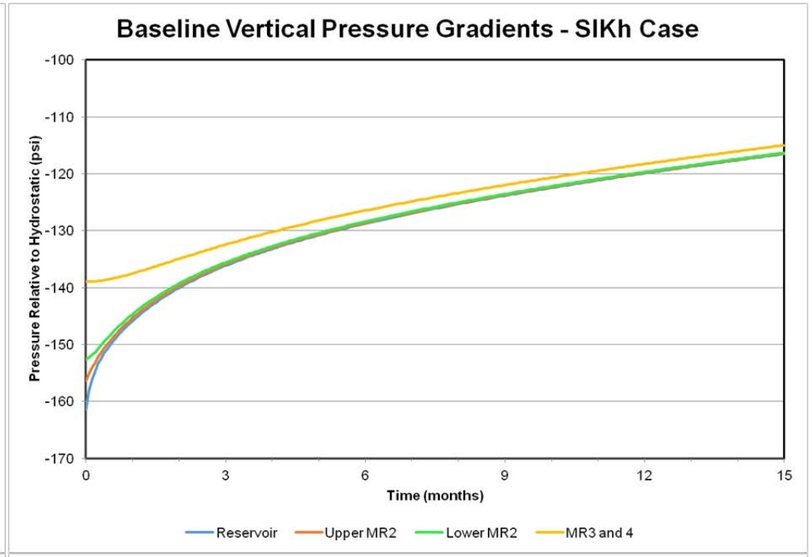


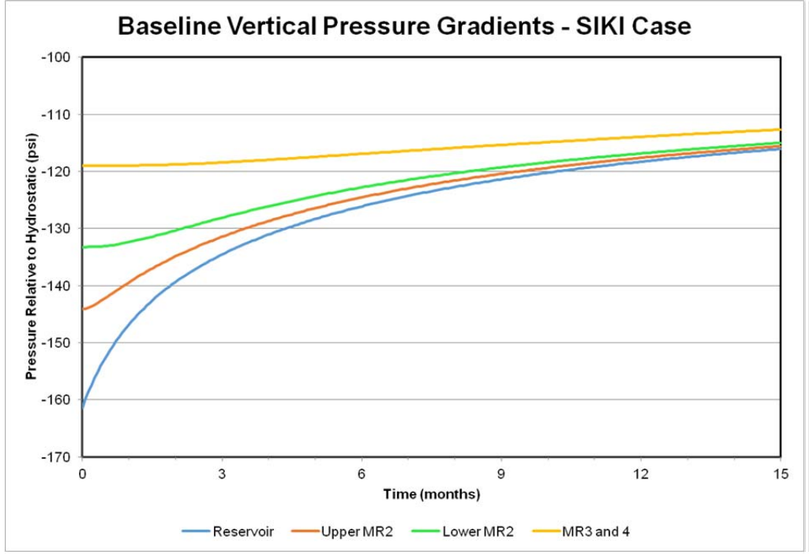


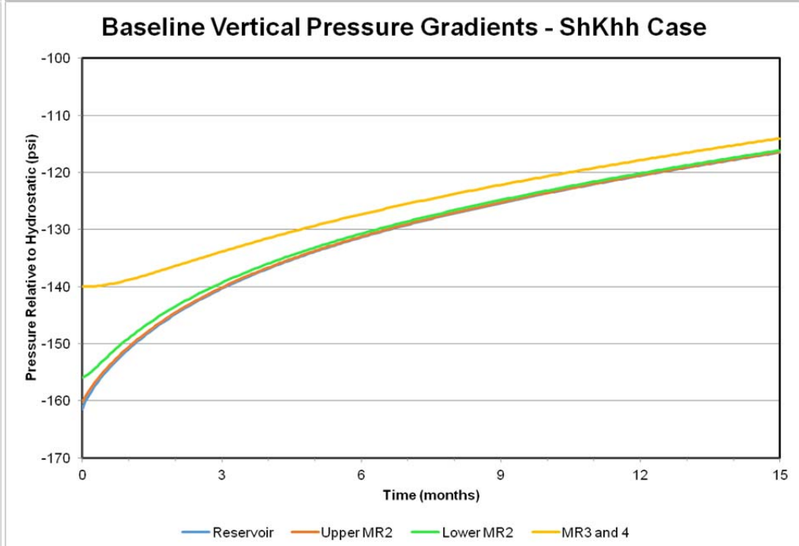
Simulated Pressure Changes in the Reservoir, Upper MR2, Lower MR2, and MR3/MR4 for each Storativity/Permeability Scenario

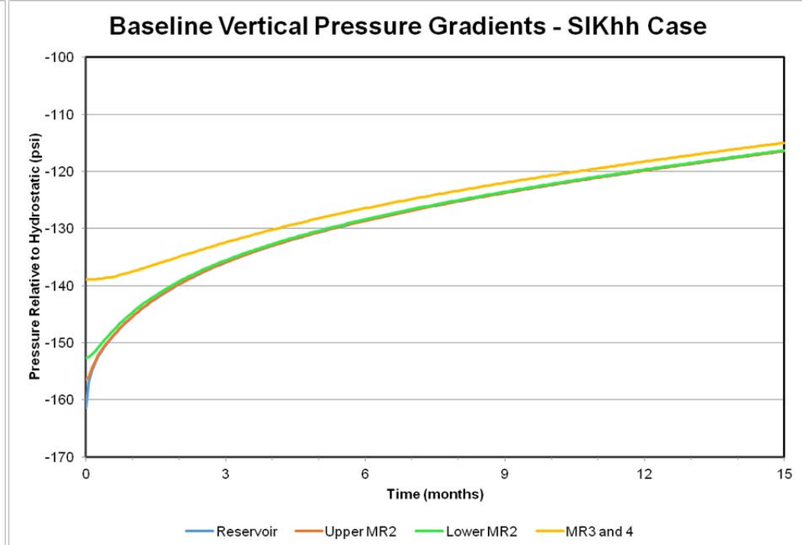












EQUIVALENT WATER INJECTION VOLUMETRIC MATERIAL BALANCE CALCULATION
(Case Sh/Kh)

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1883	psi
Average Reservoir Pressure after injection =	2028	psi
Average Reservoir Pressure near air bubble =	2294	psi
z(air) =	0.986	
z(natural gas) =	0.865	
Reservoir Temperature =	120	Deg F

Calculations:

B_g (air) =	141.80	scf/ft^3
B_g (natual gas) =	143.76	scf/ft^3
V (Gross volume air bubble) =	464.9	acre-feet
Pore Volume of Air in Bubble =	90.7	acre-feet
=	29,540,082	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,923,418	gallons
V (Post Injection Reservoir Volume of natural gas) =	52,051,543	gallons
Pore Volume Freed by Gas Compression =	3,871,875	gallons
Total Net Pore Volume Displaced by Air Injection =	25,668,207	gallons

EQUIVALENT WATER INJECTION AND PUMPING RATES (ShKh Scenario)

Test Phase	Percent of Total Injection Volume	Duration (days)	Injection/ Pumping Rate (gpm)[1]
Test Phase 1 - Oxygen-Depleted Air Bubble Build	87.5%	44	-354
Test Phases 2 & 3 - Equilibration and Testing	1.8%	21	15
Test Phase 5a - Ambient Air Injection Bubble Build	14.3%	9	-283
Test Phase 5b - Ambient Air Flow Test	8.9%	2	796

EQUIVALENT WATER INJECTION VOLUMETRIC MATERIAL BALANCE CALCULATION
(Case Sh/Kl)

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1886	psi
Average Reservoir Pressure after injection =	2078	psi
Average Reservoir Pressure near air bubble =	2287	psi
z(air) =	0.986	
z(natural gas) =	0.867	
Reservoir Temperature =	120	Deg F

Calculations:

B_g (air) =	141.37	scf/ft^3
B_g (natual gas) =	162.41	scf/ft^3

V (Gross volume air bubble) =	466.4	acre-feet
Pore Volume of Air in Bubble =	90.9	acre-feet
=	29,630,498	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,719,211	gallons
V (Post Injection Reservoir Volume of natural gas) =	46,073,690	gallons
Pore Volume Freed by Gas Compression =	9,645,521	gallons
Total Net Pore Volume Displaced by Air Injection =	19,984,977	gallons

EQUIVALENT WATER INJECTION AND PUMPING RATES (ShKl Scenario)

Test Phase	Percent of Total Injection Volume	Duration (days)	Injection/ Pumping Rate (gpm)[1]
Test Phase 1 - Oxygen-Depleted Air Bubble Build	87.5%	44	-276
Test Phases 2 & 3 - Equilibration and Testing	1.8%	21	12
Test Phase 5a - Ambient Air Injection Bubble Build	14.3%	9	-220
Test Phase 5b - Ambient Air Flow Test	8.9%	2	620

Notes:

1. Injection rates are negative and pumping rates positive.

EQUIVALENT WATER INJECTION VOLUMETRIC MATERIAL BALANCE CALCULATION
(Case Sl/Kh)

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1886	psi
Average Reservoir Pressure after injection =	2069	psi
Average Reservoir Pressure near air bubble =	2232	psi
z(air) =	0.986	
z(natural gas) =	0.867	
Reservoir Temperature =	120	Deg F

Calculations:

B_g (air) =	137.97	scf/ft^3
B_g (natual gas) =	146.57	scf/ft^3
V (Gross volume air bubble) =	477.8	acre-feet
Pore Volume of Air in Bubble =	93.2	acre-feet
=	30,360,640	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,923,418	gallons
V (Post Injection Reservoir Volume of natural gas) =	51,052,952	gallons
Pore Volume Freed by Gas Compression =	4,870,466	gallons
Total Net Pore Volume Displaced by Air Injection =	25,490,174	gallons

EQUIVALENT WATER INJECTION AND PUMPING RATES (SlKh Scenario)

Test Phase	Percent of Total Injection Volume	Duration (days)	Injection/ Pumping Rate (gpm)[1]
Test Phase 1 - Oxygen-Depleted Air Bubble Build	87.5%	44	-352
Test Phases 2 & 3 - Equilibration and Testing	1.8%	21	15
Test Phase 5a - Ambient Air Injection Bubble Build	14.3%	9	-281
Test Phase 5b - Ambient Air Flow Test	8.9%	2	790

Notes:

1. Injection rates are negative and pumping rates positive.

EQUIVALENT WATER INJECTION VOLUMETRIC MATERIAL BALANCE CALCULATION
(Case Sl/Kl)

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1883	psi
Average Reservoir Pressure after injection =	2295	psi
Average Reservoir Pressure near air bubble =	2416	psi
z(air) =	0.986	
z(natural gas) =	0.865	
Reservoir Temperature =	120	Deg F

Calculations:

B_g (air) =	149.34	scf/ft^3
B_g (natual gas) =	161.71	scf/ft^3
V (Gross volume air bubble) =	441.5	acre-feet
Pore Volume of Air in Bubble =	86.1	acre-feet
=	28,048,406	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,923,418	gallons
V (Post Injection Reservoir Volume of natural gas) =	46,274,447	gallons
Pore Volume Freed by Gas Compression =	9,648,971	gallons
Total Net Pore Volume Displaced by Air Injection =	18,399,435	gallons

EQUIVALENT WATER INJECTION AND PUMPING RATES (SlKl Scenario)

Test Phase	Percent of Total Injection Volume	Duration (days)	Injection/ Pumping Rate (gpm)[1]
Test Phase 1 - Oxygen-Depleted Air Bubble Build	87.5%	44	-254
Test Phases 2 & 3 - Equilibration and Testing	1.8%	21	11
Test Phase 5a - Ambient Air Injection Bubble Build	14.3%	9	-203
Test Phase 5b - Ambient Air Flow Test	8.9%	2	570

Notes:

1. Injection rates are negative and pumping rates positive.

EQUIVALENT WATER INJECTION VOLUMETRIC MATERIAL BALANCE CALCULATION (Case Sh/Khh)

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1883	psi
Average Reservoir Pressure after injection =	2007	psi
Average Reservoir Pressure near air bubble =	2266	psi
z(air) =	0.986	
z(natural gas) =	0.868	
Reservoir Temperature =	120	Deg F

Calculations:

B_g (air) =	140.07	scf/ft^3
B_g (natual gas) =	143.76	scf/ft^3

V (Gross volume air bubble) =	470.7	acre-feet
Pore Volume of Air in Bubble =	91.8	acre-feet
=	29,905,097	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,923,418	gallons
V (Post Injection Reservoir Volume of natural gas) =	52,051,543	gallons
Pore Volume Freed by Gas Compression =	3,871,875	gallons
Total Net Pore Volume Displaced by Air Injection =	26,033,221	gallons

EQUIVALENT WATER INJECTION AND PUMPING RATES (ShKhh, L3=L4 Scenario)

Test Phase	Percent of Total Injection Volume	Duration (days)	Injection/ Pumping Rate (gpm)[1]
Test Phase 1 - Oxygen-Depleted Air Bubble Build	87.5%	44	-360
Test Phases 2 & 3 - Equilibration and Testing	1.8%	21	15
Test Phase 5a - Ambient Air Injection Bubble Build	14.3%	9	-287
Test Phase 5b - Ambient Air Flow Test	8.9%	2	807

Notes:

1. Injection rates are negative and pumping rates positive.

EQUIVALENT WATER INJECTION VOLUMETRIC MATERIAL BALANCE CALCULATION
(Case Sl/Khh)

Equations:

G= 43,560 x PHI x (1 - Sw) x V x Bg

V = G / (43,560 x PHI x (1 - Sw) x Bg

B_g = 35.35 x P / (z x (T+460)), scf/ft^3

Assumptions:

Air Bubble Size, G =	560	MMscf
Volume Residual Gas =	1,000	MMscf
Reservoir Porosity =	30.0%	
Air Bubble Avg Sw =	35.0%	
Gas Cap Avg Sw =	20.0%	
Average Reservoir Pressure before injection =	1883	psi
Average Reservoir Pressure after injection =	2045	psi
Average Reservoir Pressure near air bubble =	2210	psi
z(air) =	0.986	
z(natural gas) =	0.867	
Reservoir Temperature =	120	Deg F

Calculations:

B_g (air) =	136.61	scf/ft^3
B_g (natual gas) =	143.76	scf/ft^3
V (Gross volume air bubble) =	482.6	acre-feet
Pore Volume of Air in Bubble =	94.1	acre-feet
=	30,662,873	gallons
V (Pre-Injection Pore Volume of natural gas) =	55,923,418	gallons
V (Post Injection Reservoir Volume of natural gas) =	52,051,543	gallons
Pore Volume Freed by Gas Compression =	3,871,875	gallons
Total Net Pore Volume Displaced by Air Injection =	26,790,998	gallons

EQUIVALENT WATER INJECTION AND PUMPING RATES (Sl Khh, L3=L4 Scenario)

Test Phase	Percent of Total Injection Volume	Duration (days)	Injection/ Pumping Rate (gpm)[1]
Test Phase 1 - Oxygen-Depleted Air Bubble Build	87.5%	44	-370
Test Phases 2 & 3 - Equilibration and Testing	1.8%	21	16
Test Phase 5a - Ambient Air Injection Bubble Build	14.3%	9	-295
Test Phase 5b - Ambient Air Flow Test	8.9%	2	831

Notes:

1. Injection rates are negative and pumping rates positive.

Calculation of Specific Storage Based on Total Compressibility of Formation, Water and Trapped Gas

Equations:

Total Compressibility, Ct = Cr + SgCg + SwCw
Specific Storage=PHIx0.433xCt

Assumptions:

Porosity = 30%
Cr = 3.600E-06
Cw = 2.860E-06

Pressure (psi)	Rock Compressibility (Cr)	Water Compressibility (Cw)	Gas Compressibility (Cg)	Water Saturation (Sw)	Trapped Gas Saturation (Sg)	Total Compressibility (Ct)	Specific Storage (1/ft)
1,900	3.600E-06	2.870E-06	5.508E-04	84.0%	16.0%	9.414E-05	1.223E-05
2,000	3.600E-06	2.860E-06	5.186E-04	84.0%	16.0%	8.898E-05	1.156E-05
2,100	3.600E-06	2.850E-06	4.875E-04	84.0%	16.0%	8.399E-05	1.091E-05
2,200	3.600E-06	2.840E-06	4.595E-04	84.0%	16.0%	7.951E-05	1.033E-05
2,300	3.600E-06	2.830E-06	4.344E-04	84.0%	16.0%	7.548E-05	9.805E-06
2,400	3.600E-06	2.820E-06	4.095E-04	84.0%	16.0%	7.149E-05	9.286E-06
2,500	3.600E-06	2.810E-06	3.869E-04	84.0%	16.0%	6.786E-05	8.816E-06

Correlation Cr= 3.600E-06 (Neuman)

Trapped Gas Percent Saturation Calculation

Given:

Total Gas Remaining (MMscf))	3,500
Attick Gas Remaining (MMscf)	1,000
Reservoir Area (acres)	229
Net Reseroiv Sand Thickness (ft)	40
Reservoir Porosity	30%
Reservoir Pressure (psi)	1,883
Bg (scf/ft3 @1,883 psi)	131.91

Calculations:

Trapped Gas Remaining (MMscf)	2,500
Trapped Gas Res Vol @ 1883 psi (acre-ft)	435
Reservoir Trapped Gas Gross Volume (acre-ft)	9,169
Trapped Gross Pore Volume (acre-ft)	2,751
Trapped Gas Saturation (Sg)	16%

OGIP Calculation

Given:

Reservoir Area (acres)	229
Average Net Reseroir Sand above Original Gas-Water Contact (ft)	40
Reservoir Porosity	30%
Sw	20%
Reservoir Discovery Pressure (psi)	2,080
Bg (scf/ft3 @2080 psi)	146.22

Calculations:

Original Gas in Place @ Res Pressure (acre-ft)	2,201
Original Gas in Place @ Res Pressure (MMcf)	95,854
Original Gas in Place (Bscf)	14

Remaining Gas Cap Volume Calculation

Given:

Reservoir Area (acres)	229
Average Net Reseroir Sand above Original Gas-Water Contact (ft)	3
Reservoir Porosity	30%
Sw	20%
Reservoir Discovery Pressure (psi)	2,080
Bg (scf/ft3 @2080 psi)	146.22

Calculations:

Original Gas in Place @ Res Pressure (acre-ft)	165
Original Gas in Place @ Res Pressure (MMcf)	7,189
Original Gas in Place (Bscf)	1

Relative Permeability Calculation for Reservoir Sand with Trapped Gas

Equation:

$K(s) = K(1)s^c$ (Bras, 1990)

Where:

s = saturation
k(s) = permeability at a given saturation
k(1) = fully saturated permeability
c = the pore disconnectedness index
= (2+3m)/m
m = the pore size distribution index.
Values for m are provided for typical lithologies in Bras, 1990.

Given:

s =	0.84	
m =	5.4	
k(1) =	807	mD

Calculation:

c=	3.3704	
k(s) =	448	mD
K(s) =	1.2	ft/day

Analysis

Date-Time: 01/17/13 16:08 Analysis Time: 348 Cycle Time: 360
Stream: 2 Sample 2 Mode: ANLY Cycle Start Time: 16:03
Analyzer: Sacramento Strm Seq:11
Pacific Gas & Electric

Component Name	Mole Percent	BTU Gross	Relative Density
C6+ 50/50/00	0.0000	0.00	0.0000
PROPANE	18.0ppm	0.05	0.0000
i-BUTANE	0.0000	0.00	0.0000
n-BUTANE	0.0000	0.00	0.0000
i-PENTANE	0.0000	0.00	0.0000
n-PENTANE	0.0000	0.00	0.0000
NITROGEN	8.1311	0.00	0.0786
METHANE	91.7241	928.56	0.5081
CARBON DIOXIDE	0.0138	0.00	0.0002
ETHANE	0.1292	2.29	0.0013
TOTALS	100.0000	930.90	0.5883

'*' indicates user-defined components

Compressibility Factor (1/Z) @ 14.73000 PSIA & 60.0 DEG.F= 1.00181

Base Pressures 14.73000

Gross Dry BTU = 932.58 Corrected/Z
Real Relative Density Gas = 0.5891
Unnormalized Mole Percent = 98.691
WOBBE = 1215.04

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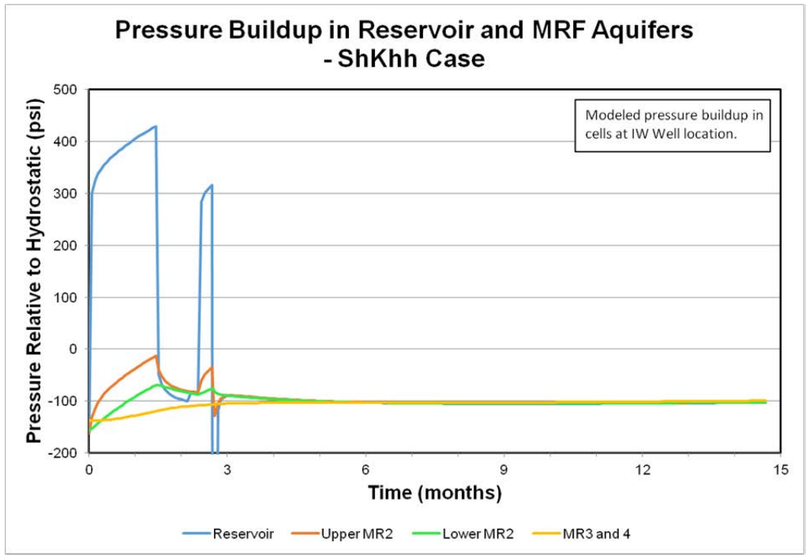
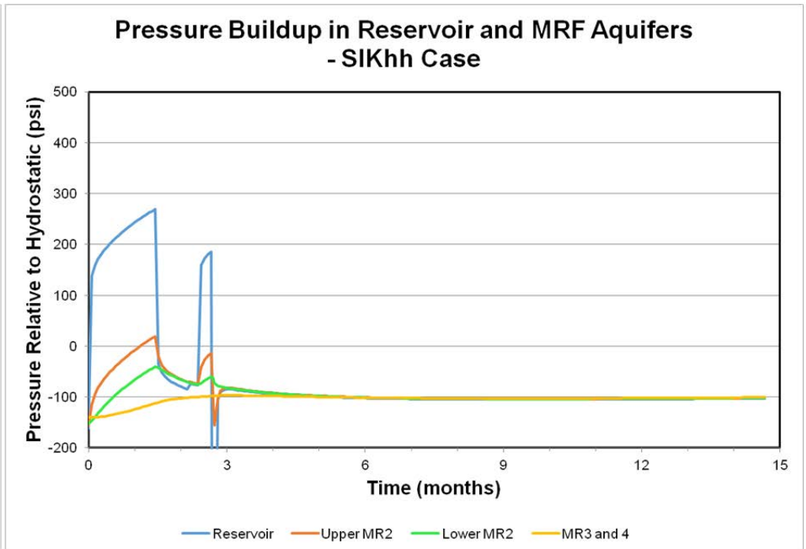
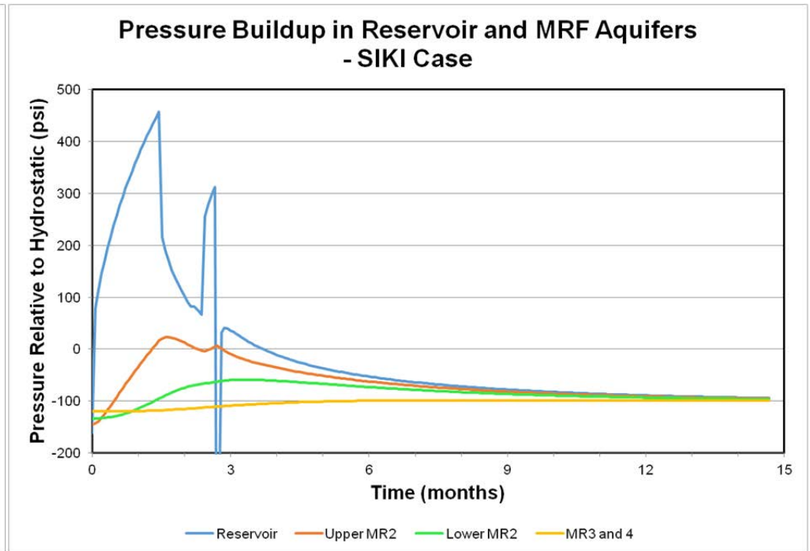
ATTACHMENT A-2

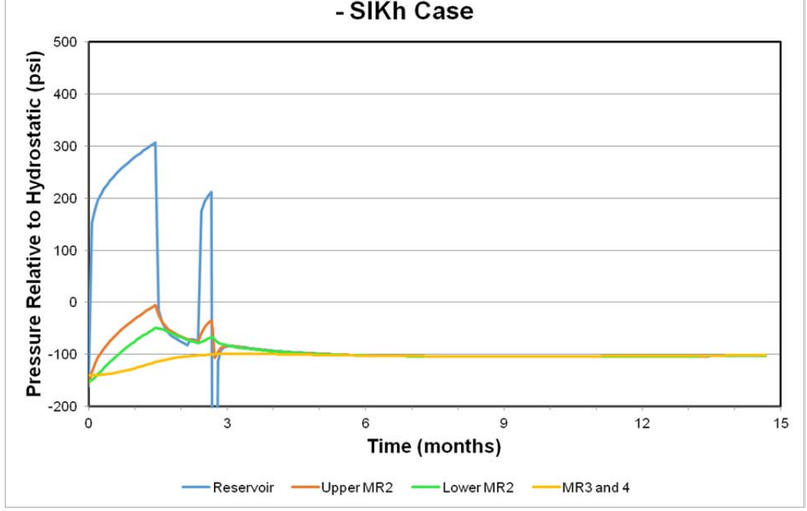
Mokelumne River Formation Pressure Buildup Model Results

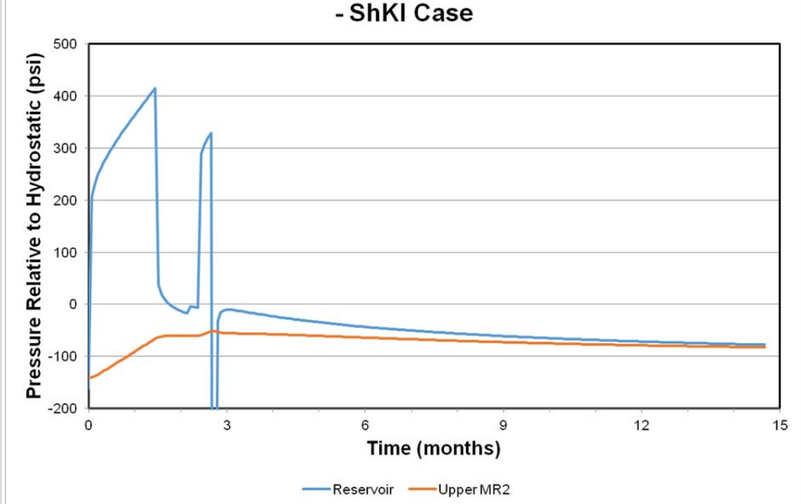
DWI-LJK !πHl· π Predicted Pressure Buildup in Reservoir and Underlying Mokelumne RIver Formation Aquifers at and Beneath I/W Well Location

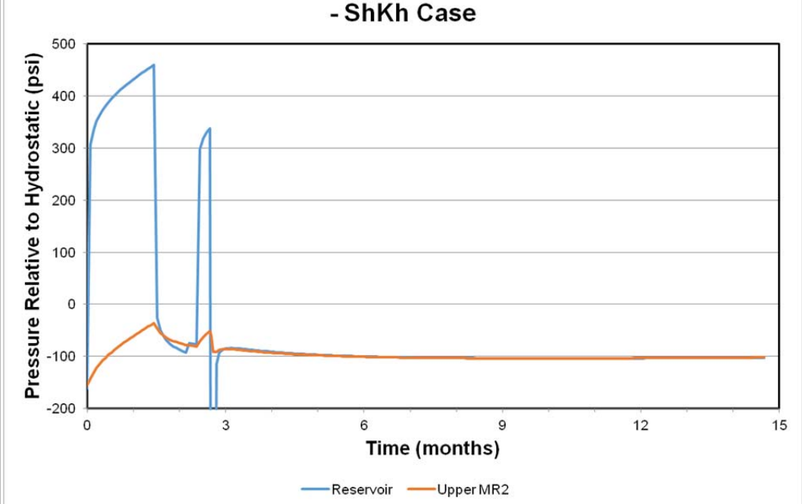




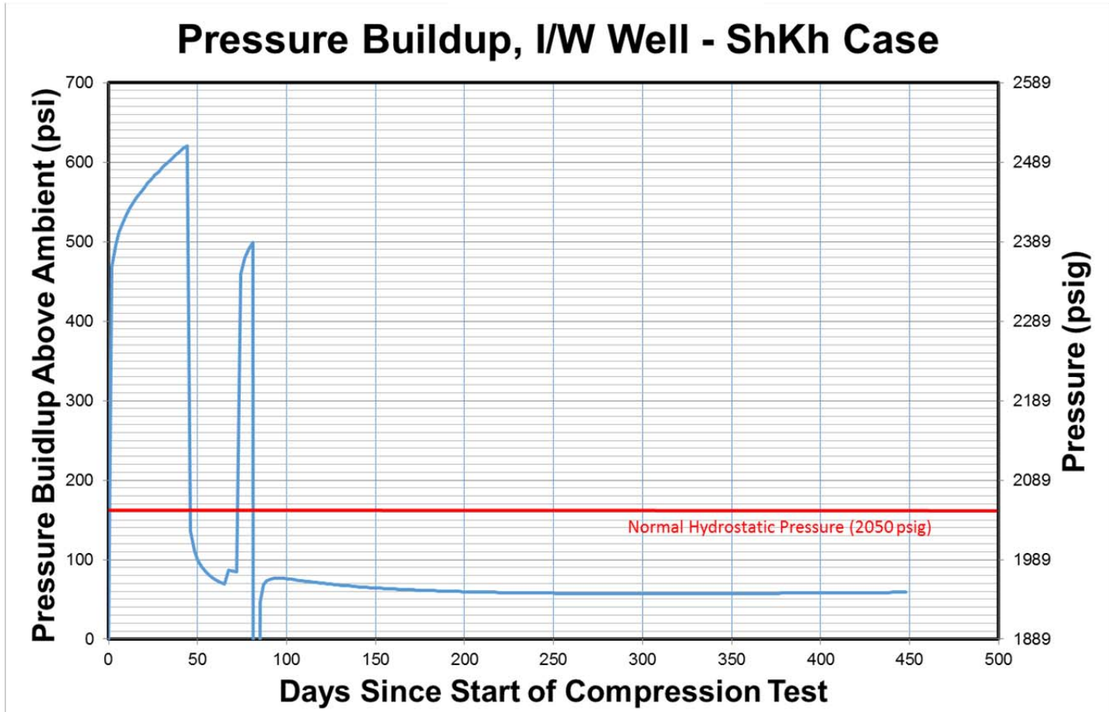


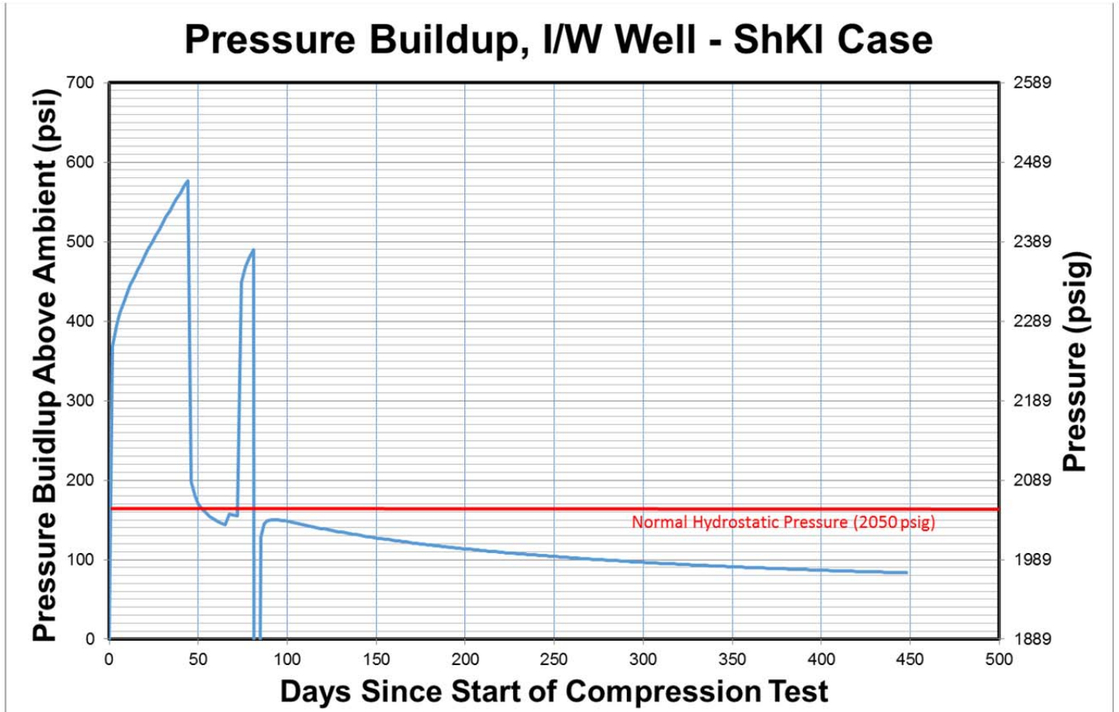


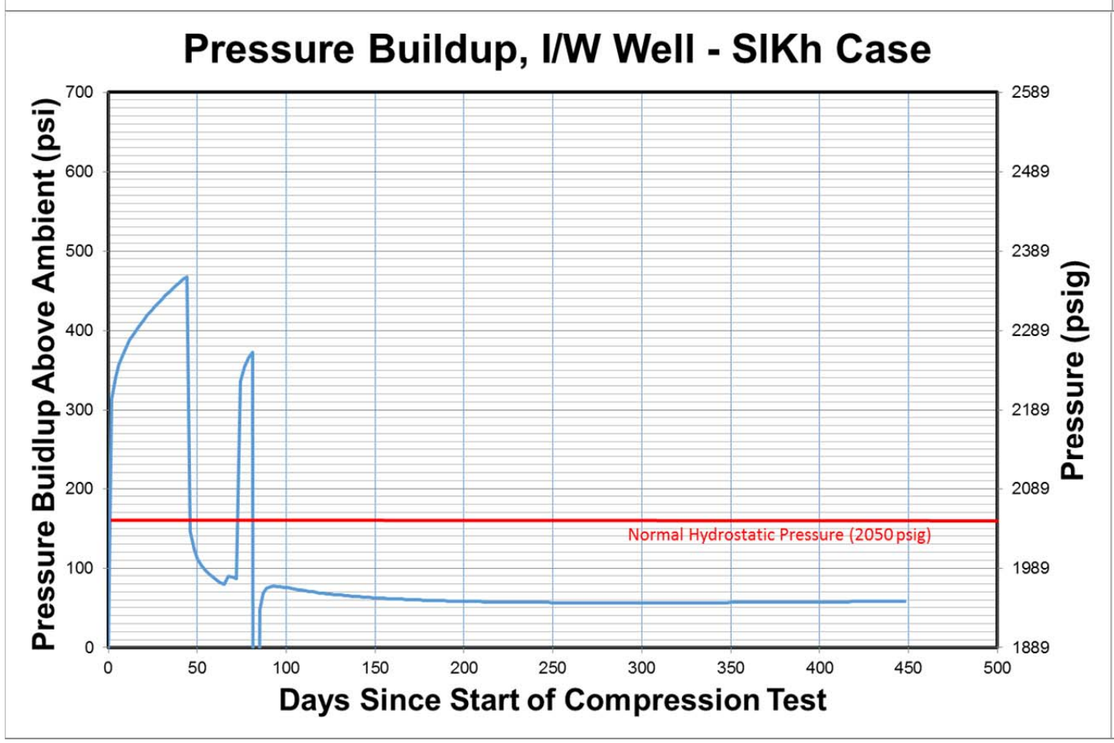


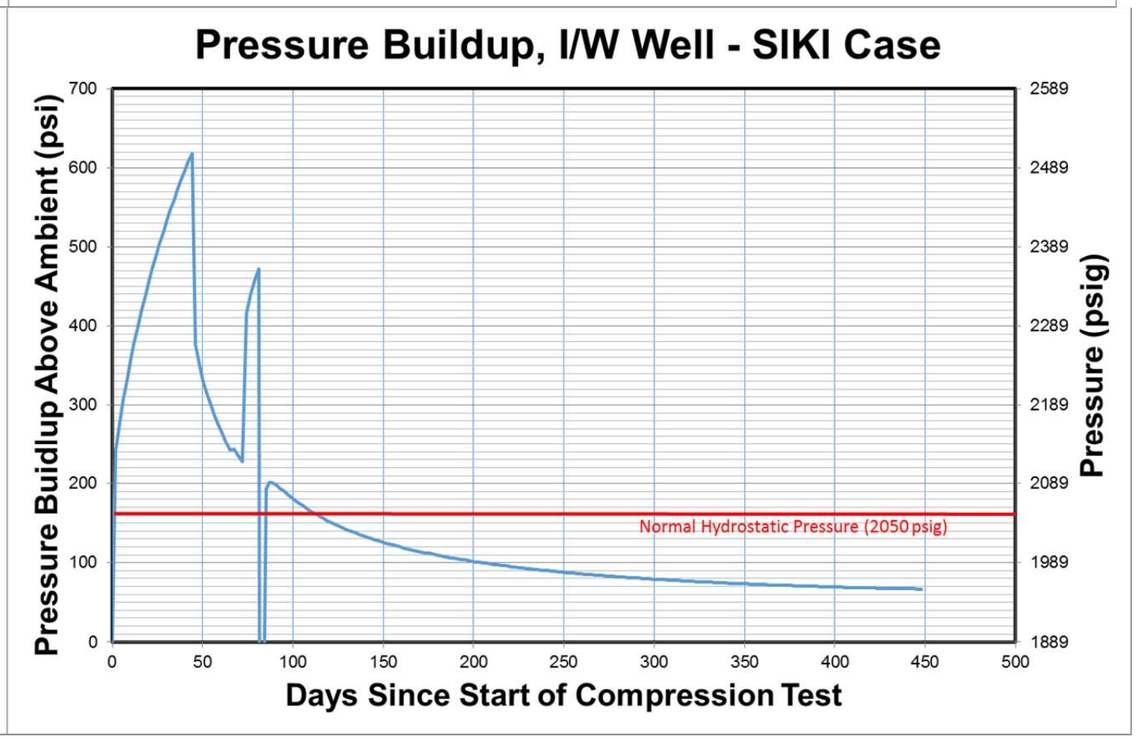


Graph A-2b - Predicted Pressure Buildup

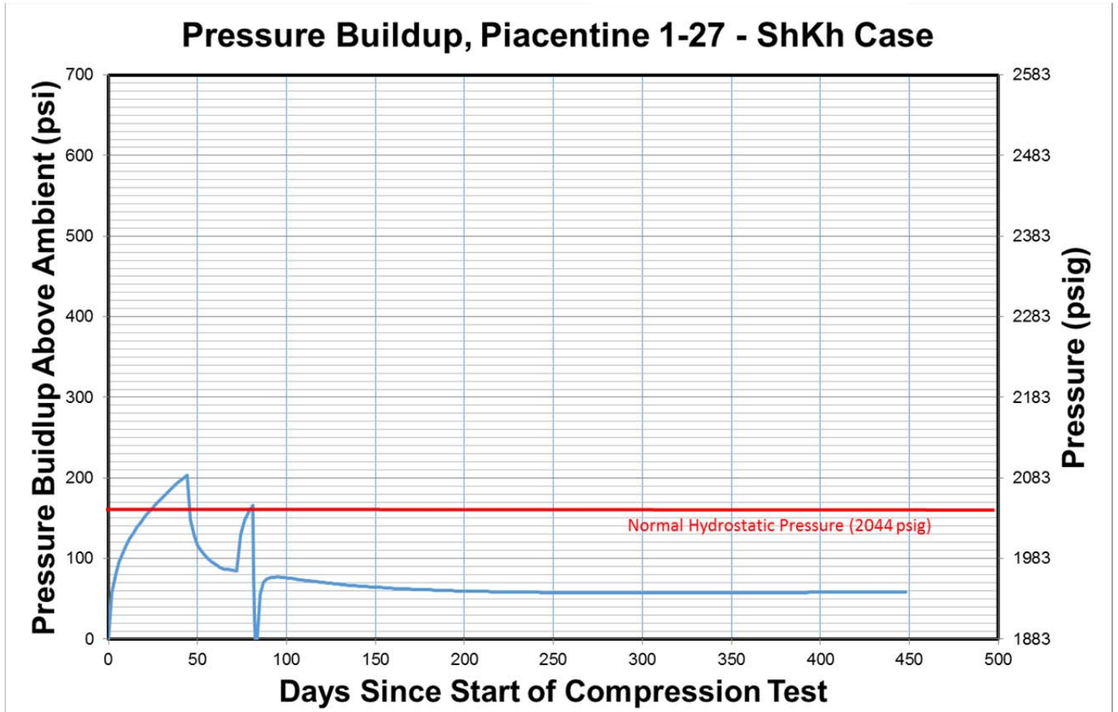


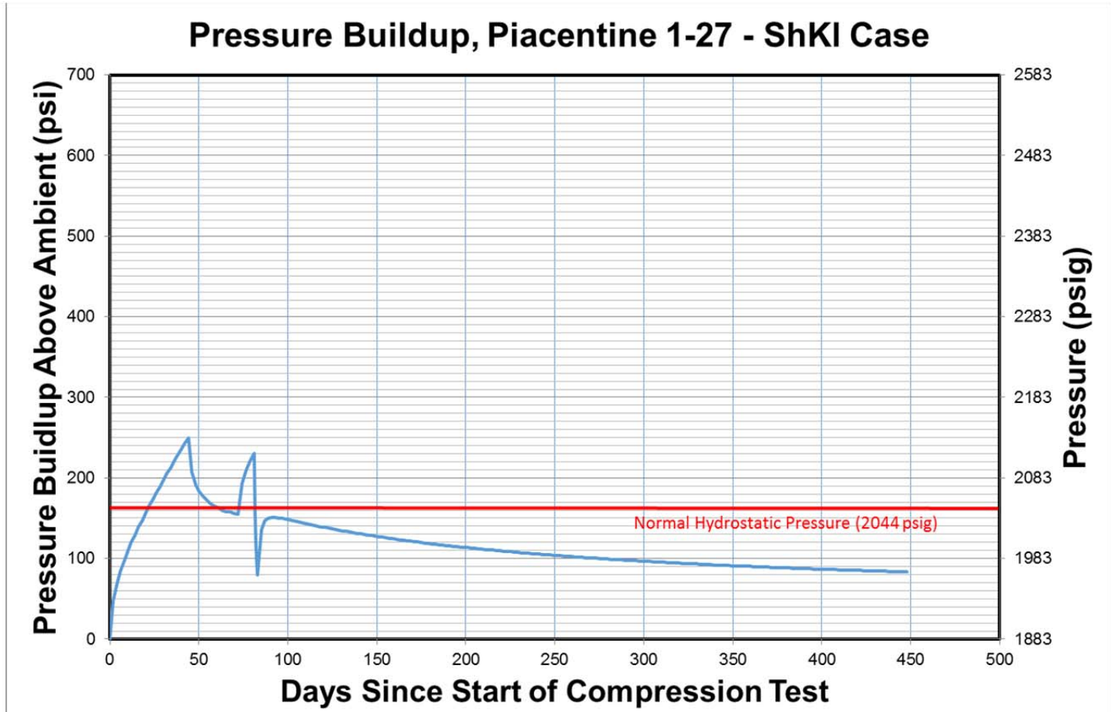


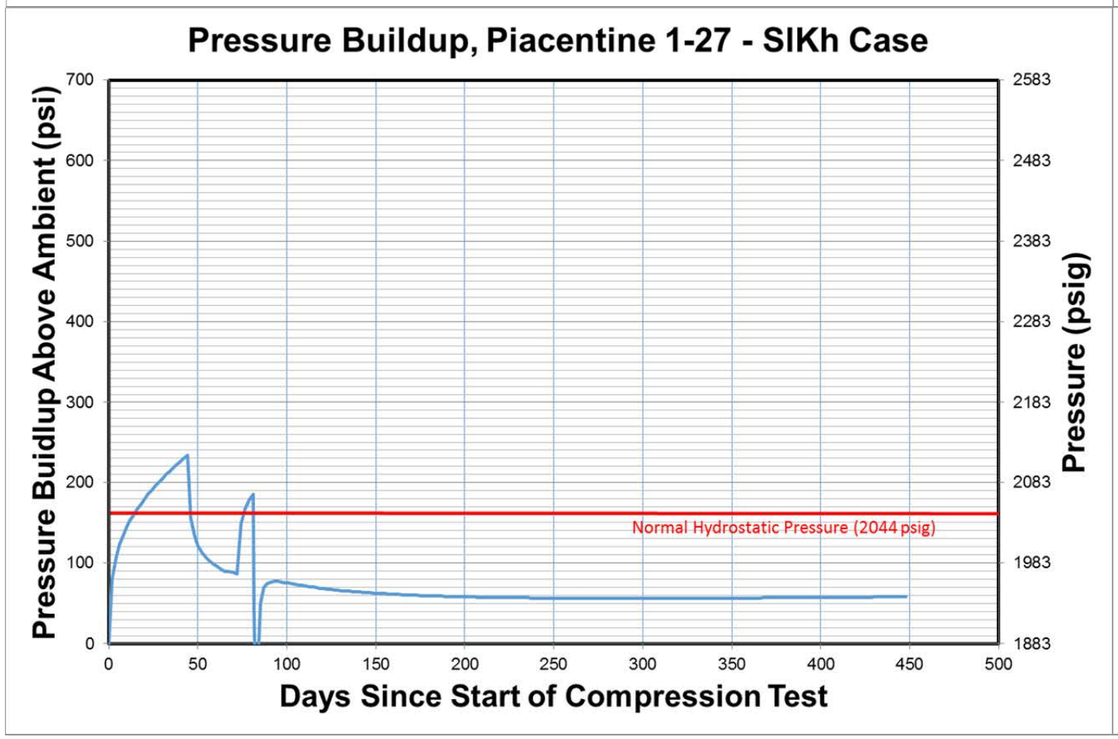


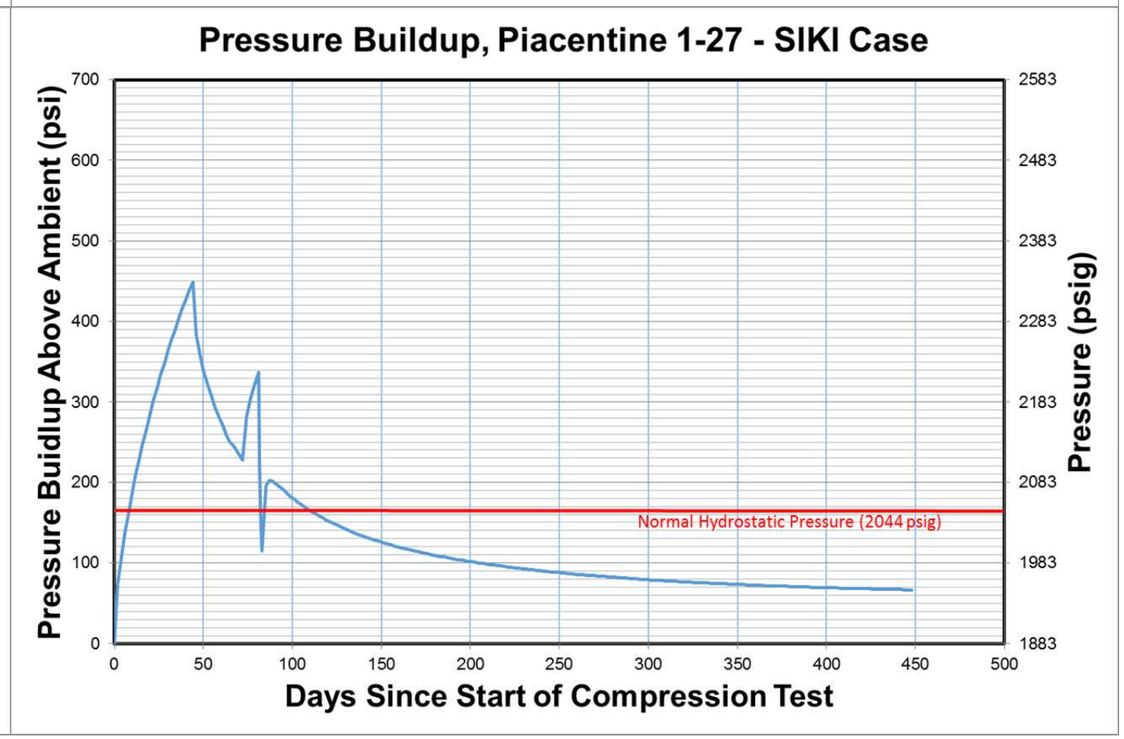


Graph A-2b - Predicted Pressure Buildup

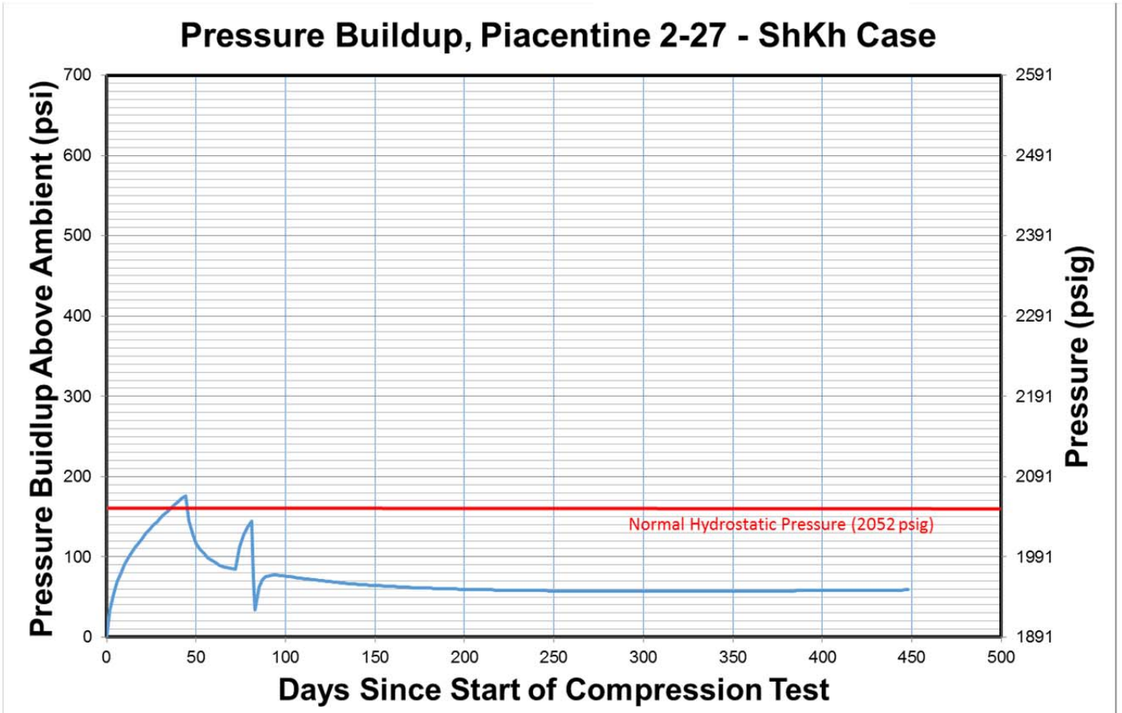


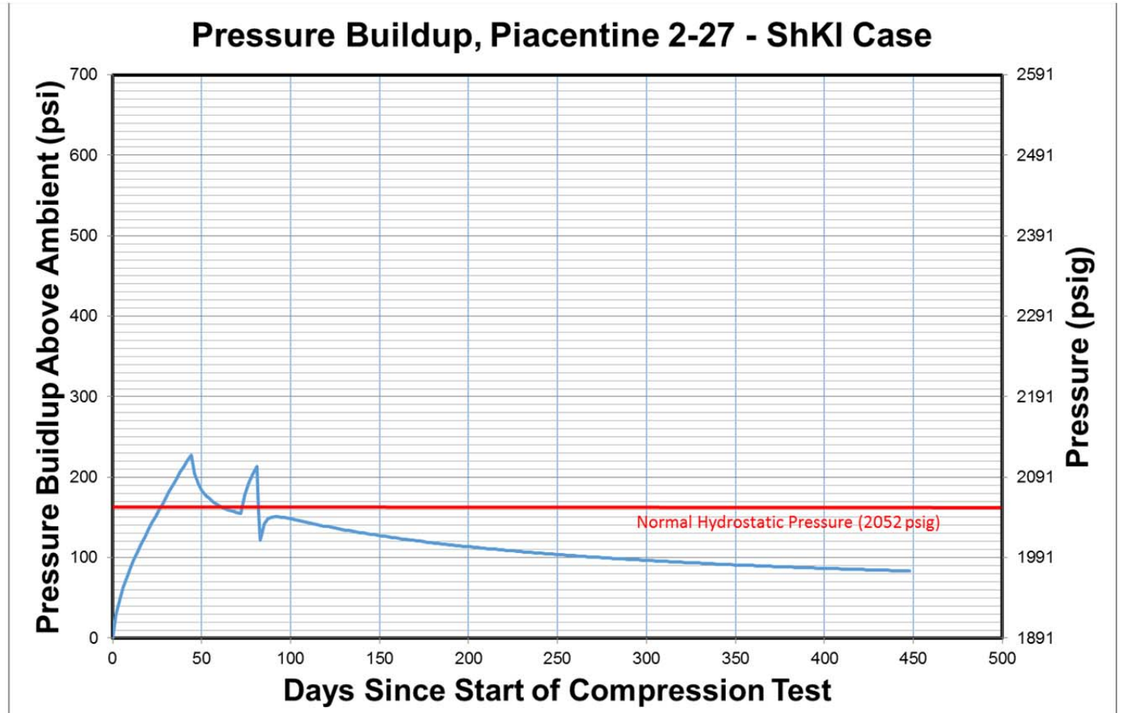


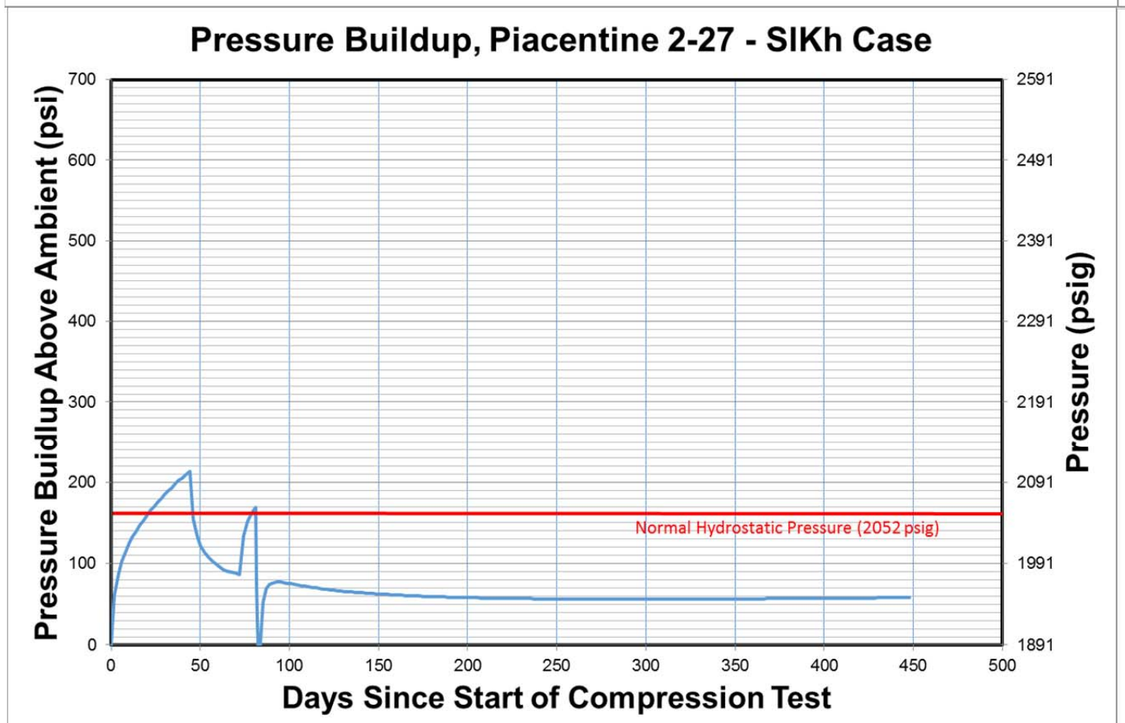


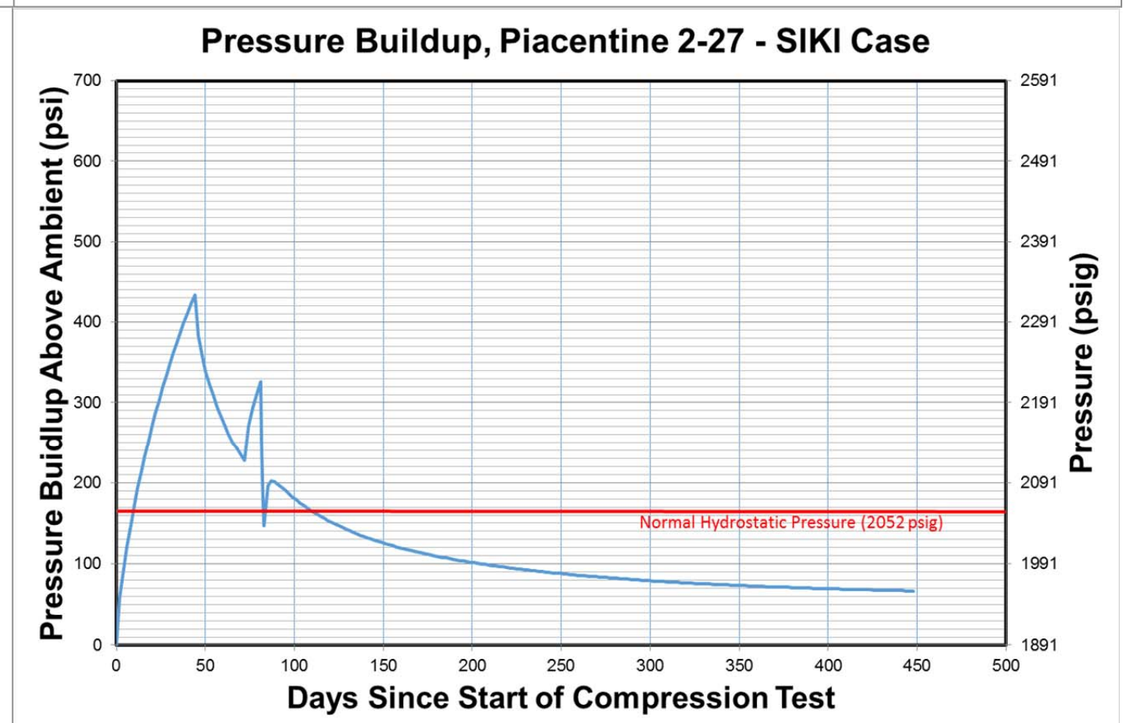


Graph A-2b - Predicted Pressure Buildup

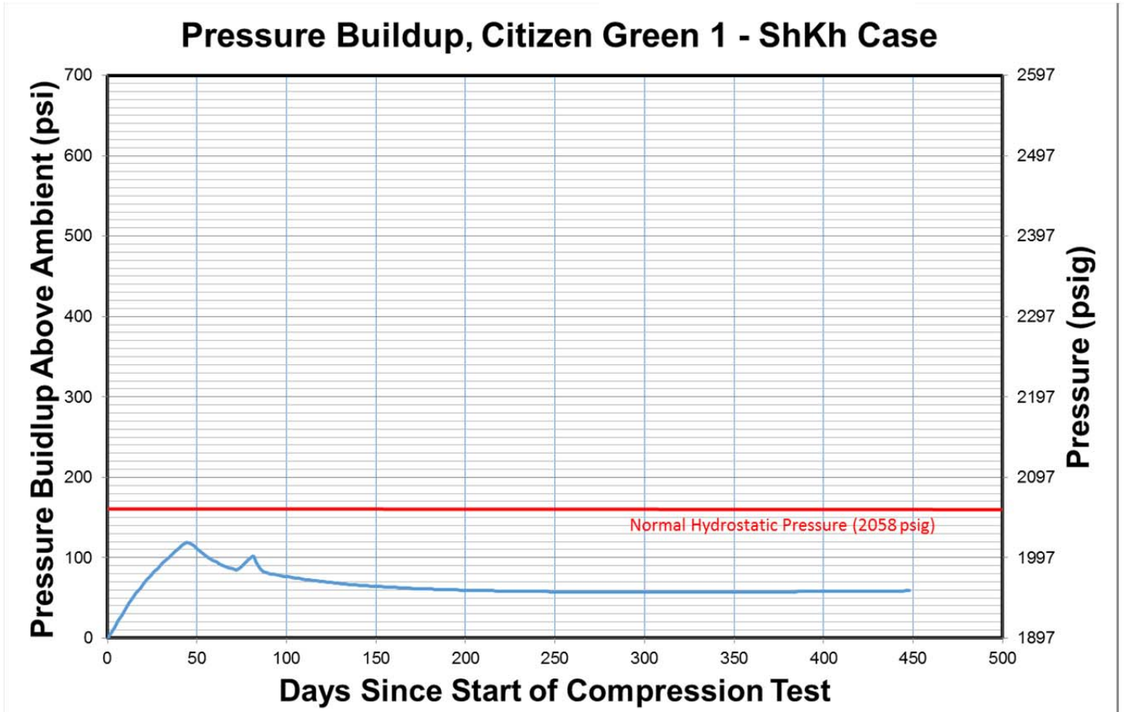


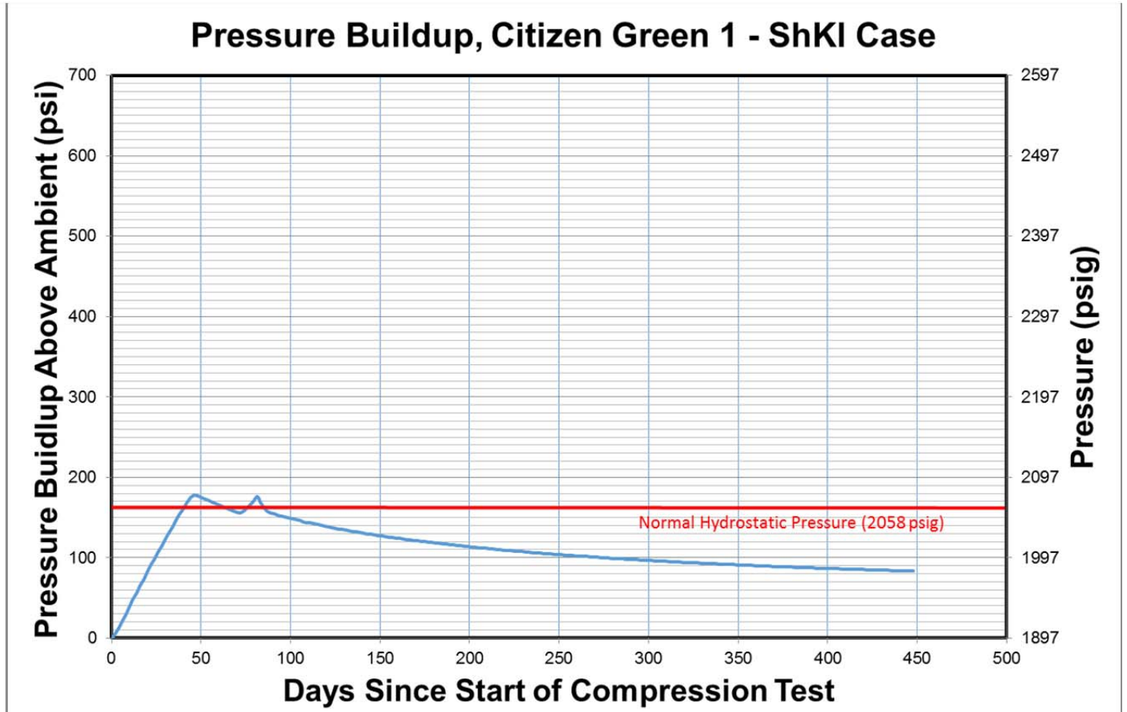


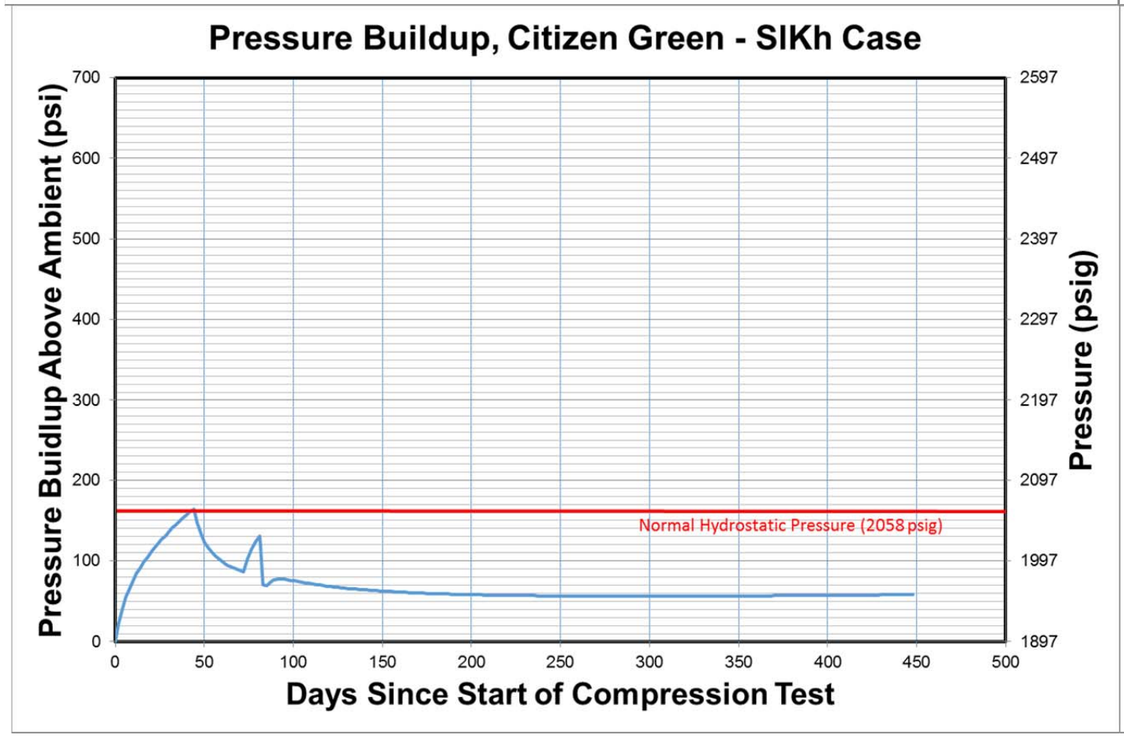


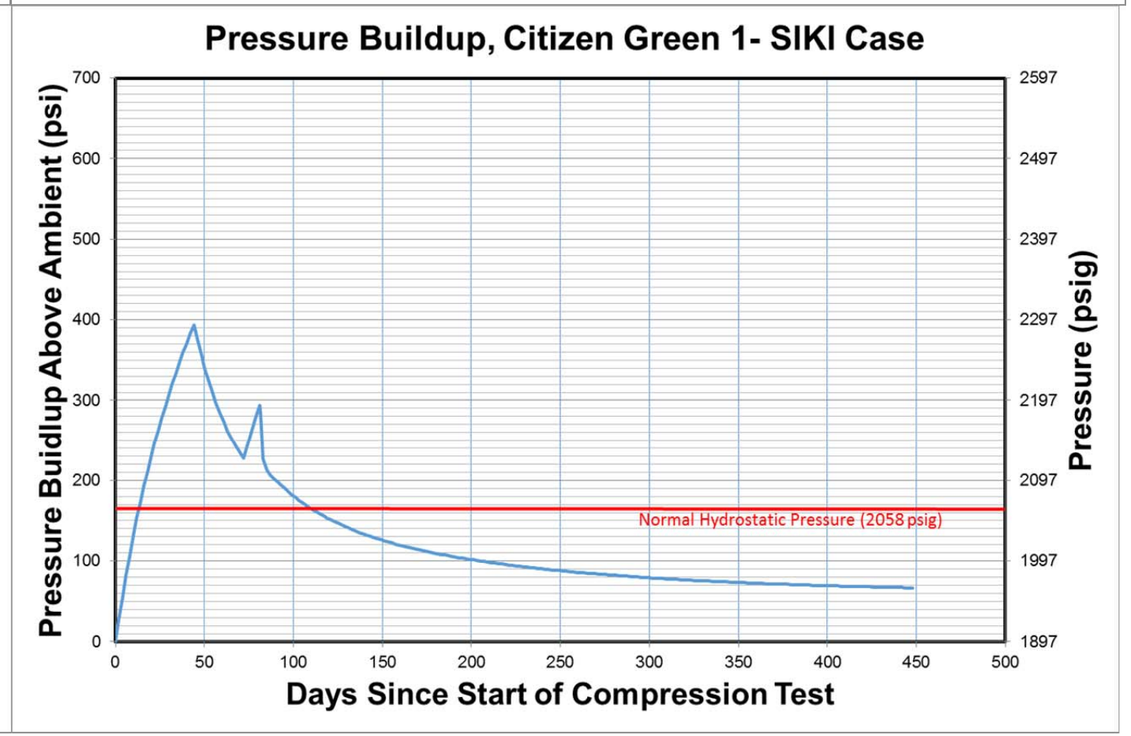


Graph A-2b - Predicted Pressure Buildup

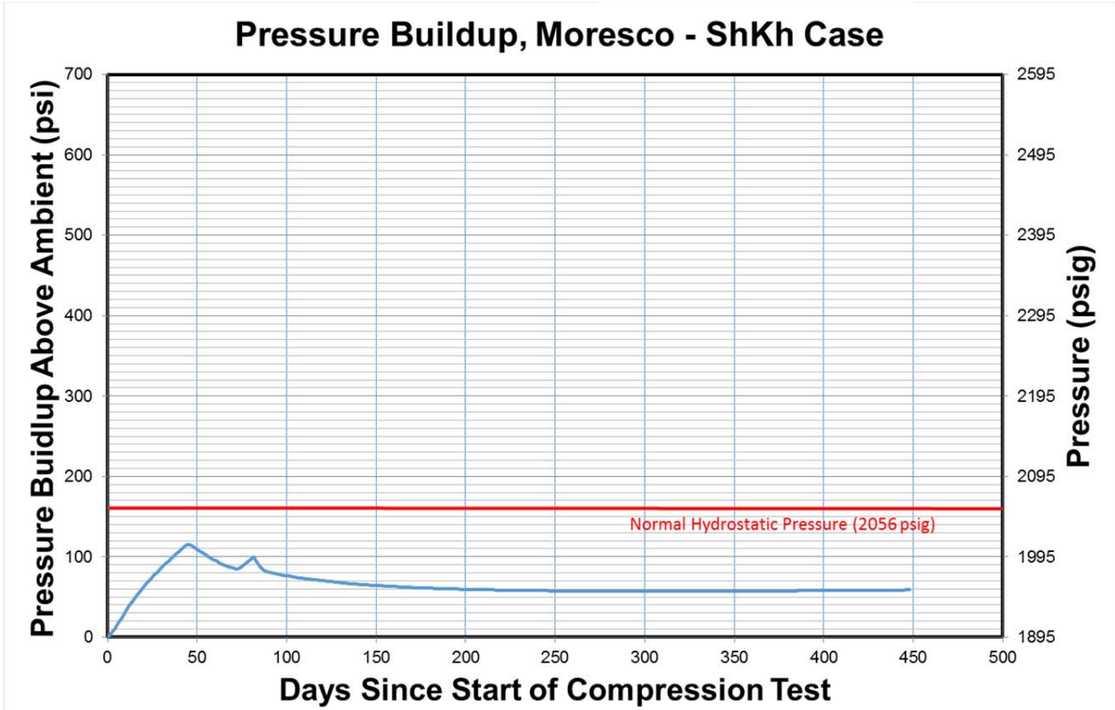


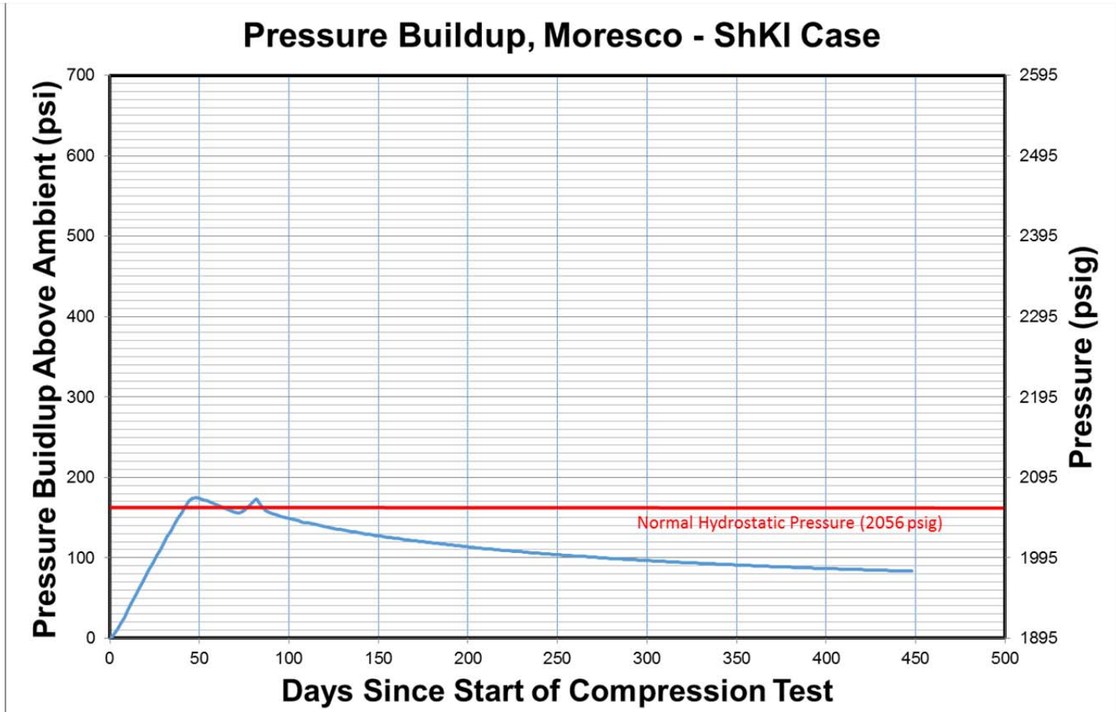


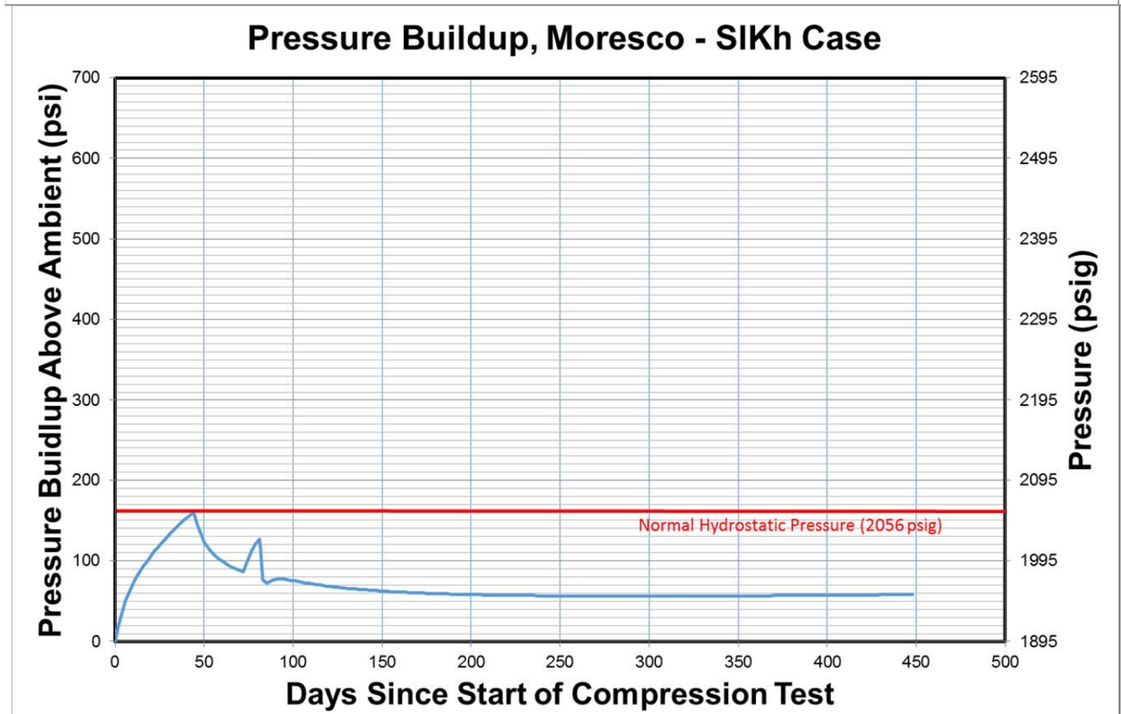


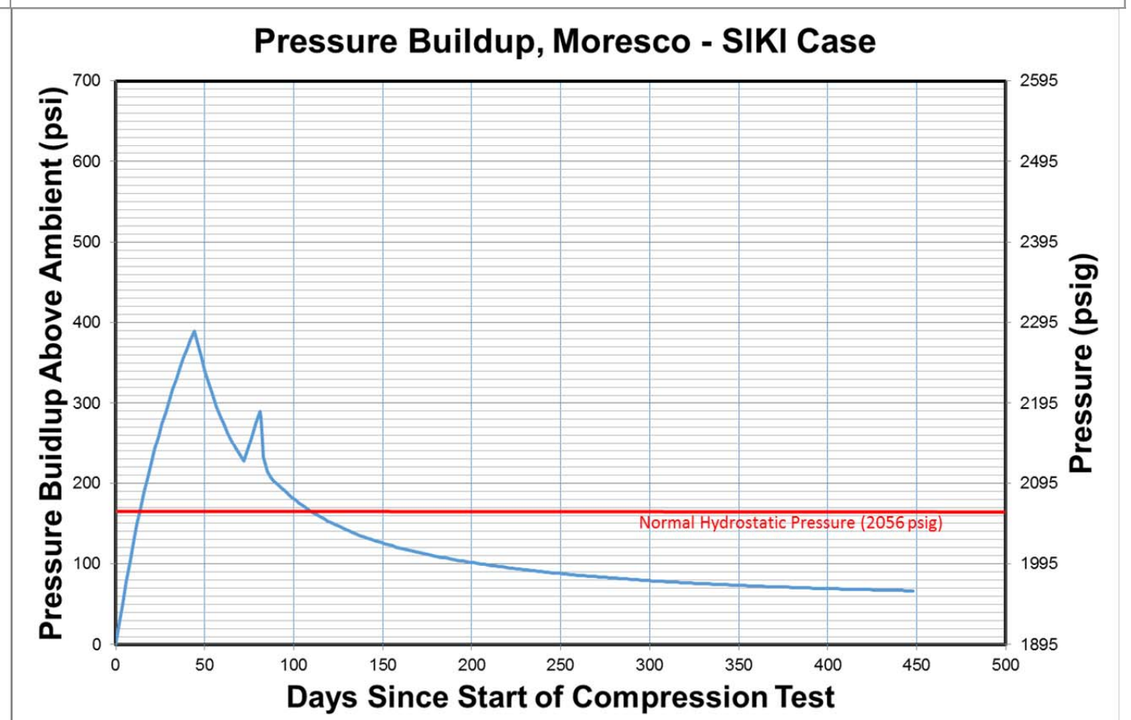


Graph A-2b - Predicted Pressure Buildup

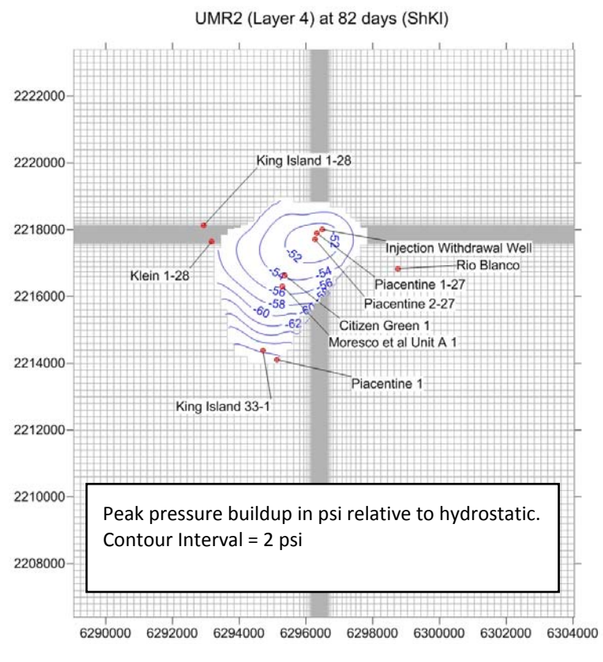


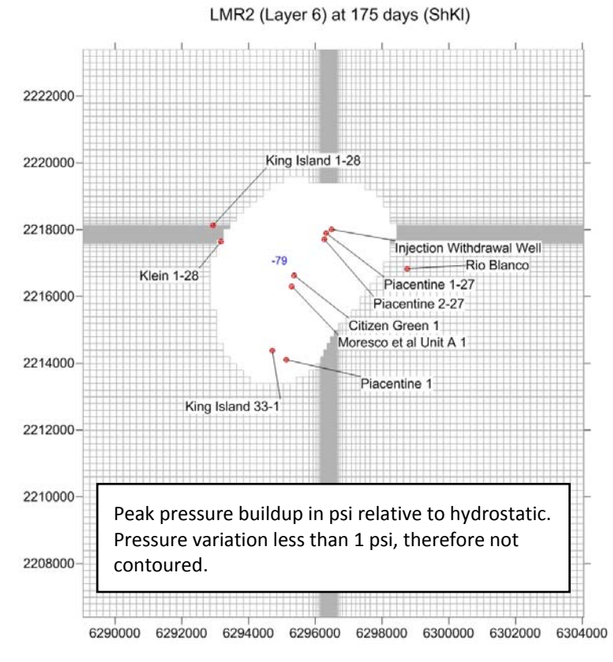


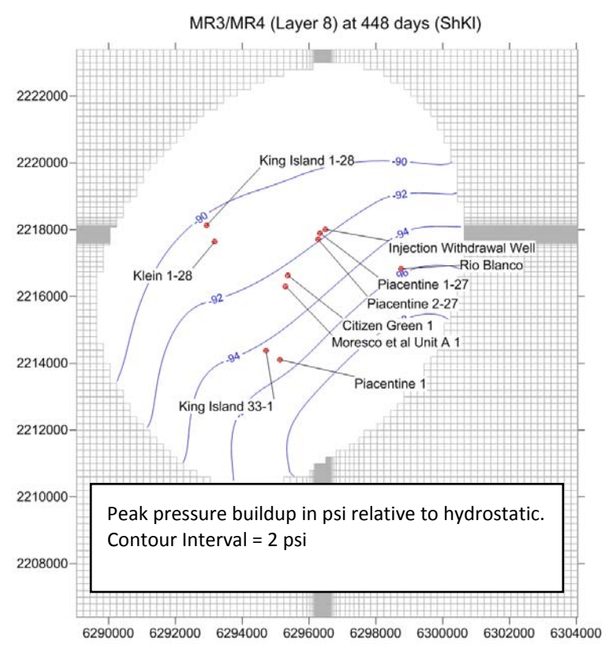


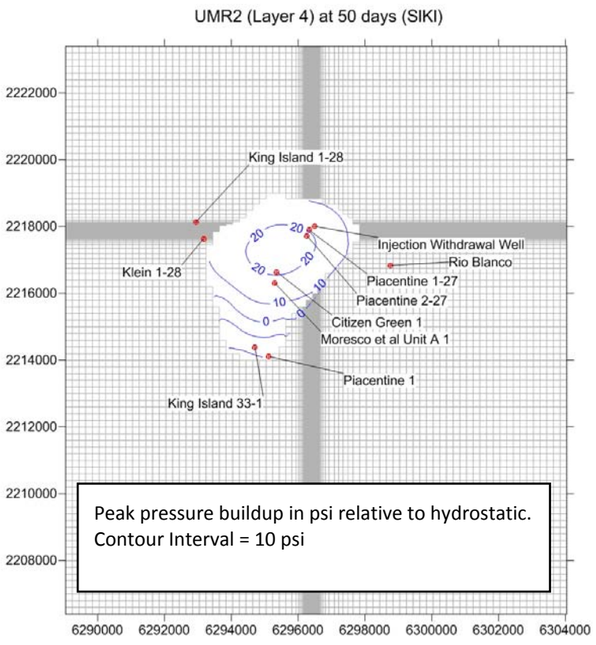


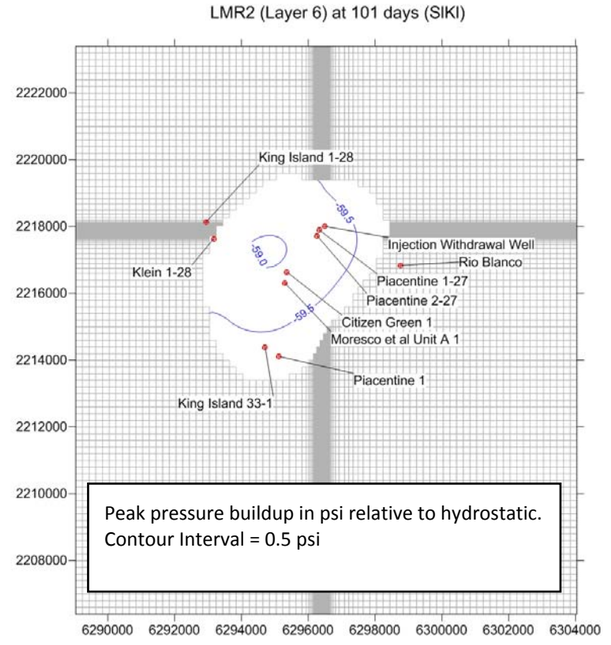
/2yú2dzW tf2ú !πHl· π Predicted Pressure Buildup at Mokelumne River Formation Aquifers

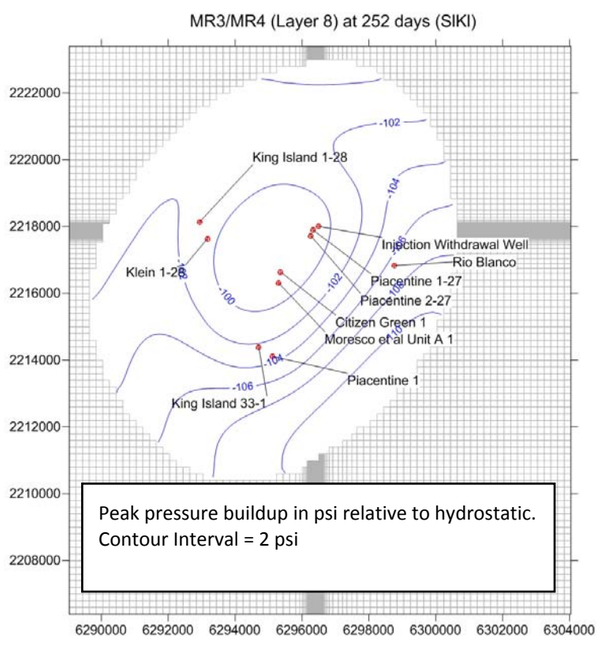




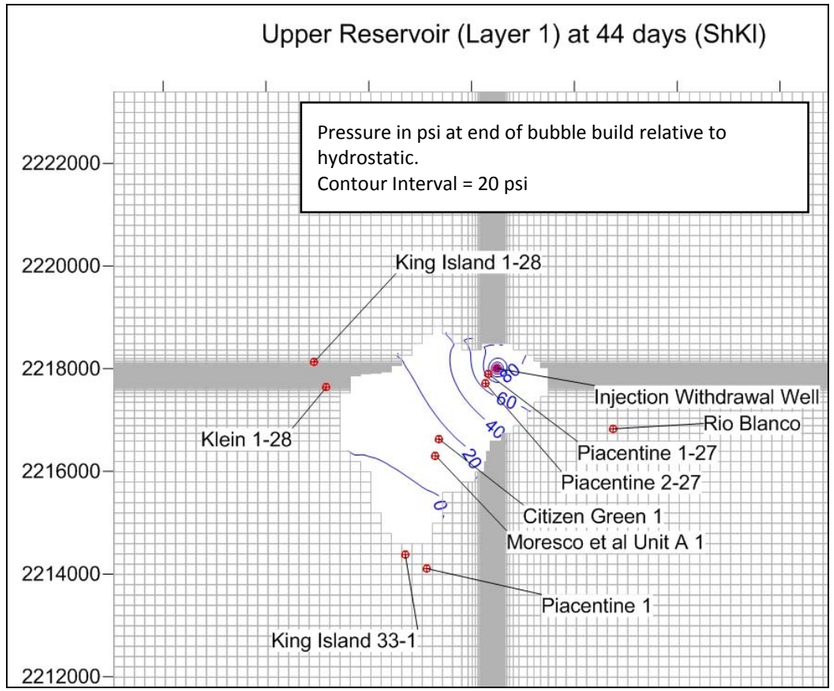


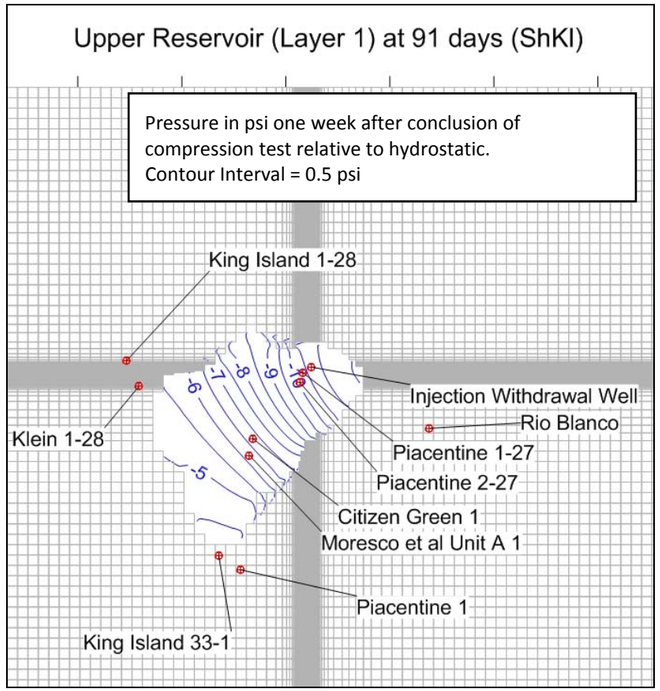


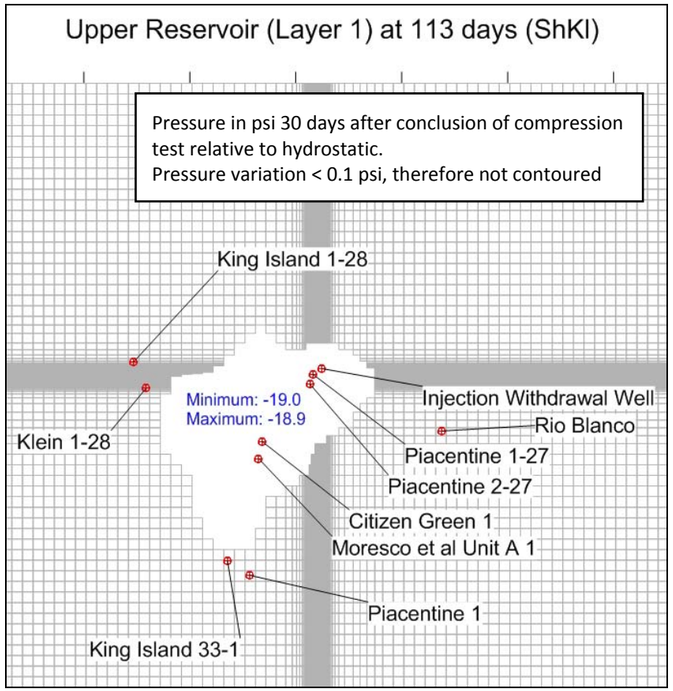


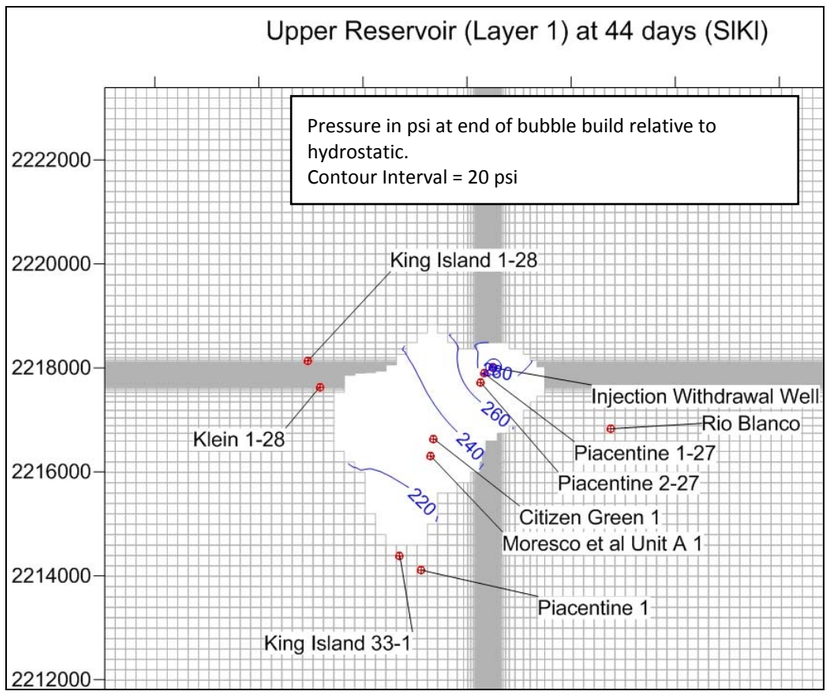


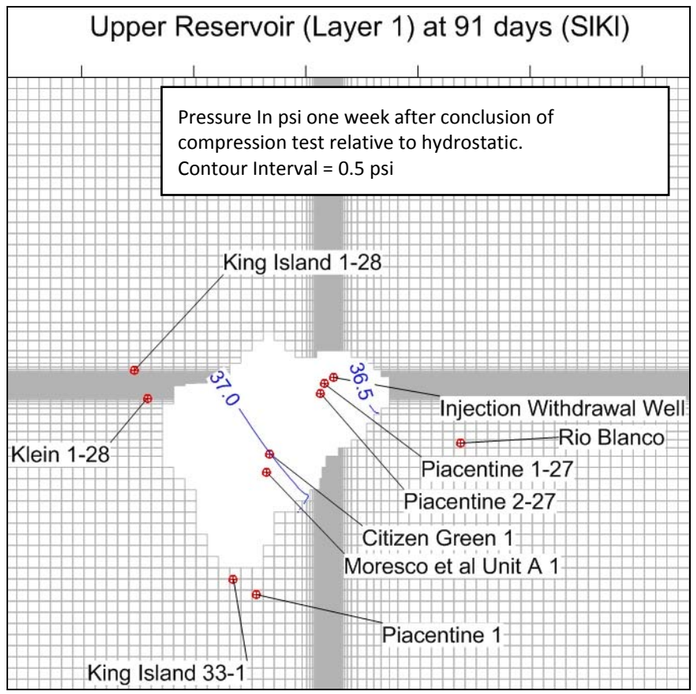
Contour Plot A-2-b - Predicted Pressure Dissipation in Reservoir Over Time

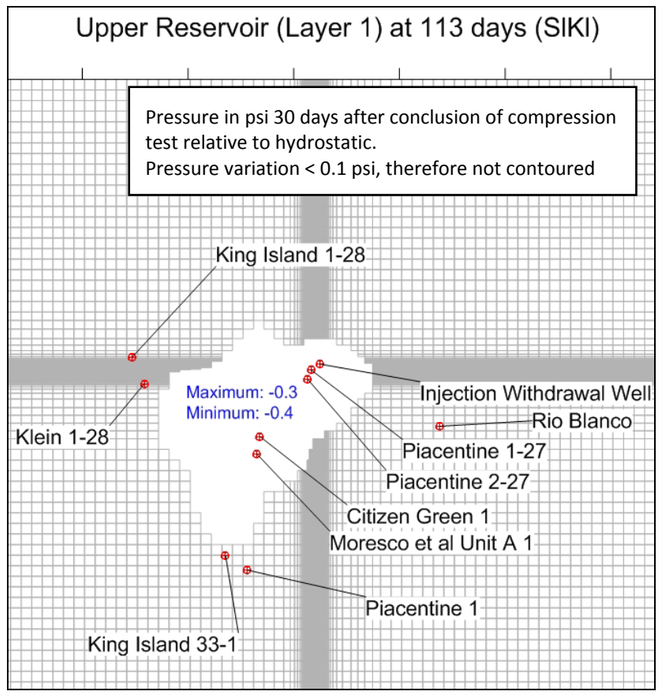












Attachment A-3: THWELLS Model Inputs and Boundary Conditions

Pressure increase was evaluated by simulating injection into an infinite aquifer using THWELLS and representing a laterally continuous and combined aquifer consisting of connecting sands in the Mokelumne River Formation and the Meganos Channel fill. The aquifer model was run under four different scenarios:

- Scenario 1: Aquifer thickness of 50 feet with no impermeable boundaries;
- Scenario 2: Aquifer thickness of 50 feet with an impermeable boundary to the south at the approximate location of the mapped normal fault;
- Scenario 3: Aquifer thickness of 100 feet with no impermeable boundaries; and
- Scenario 4: Aquifer thickness of 100 feet with an impermeable boundary to the south at the approximate location of the mapped normal fault.

The locations of the Injection/Withdrawal Well, impermeable boundary, and image well (to simulate the impermeable boundary) are shown in the attached figure relative to the site vicinity. The derivation of the model boundary and input parameters is summarized below.

- Modeled Aquifer Dimensions. The model simulates water flow and pressure in an infinite, homogeneous and isotropic aquifer with and without an impermeable boundary located approximately 4,100 feet from the Injection/Withdrawal Well in Scenarios 2 and 4. If the fault represents an impermeable boundary, it will tend to increase pressure buildup to the north and prevent pressure buildup to the south. Scenarios 1 and 3 evaluated pressure buildup without the fault, including the area to the south.
- Aquifer Thickness. Two alternative aquifer thicknesses were evaluated, 50 and 100 feet. These thicknesses are in the range of thickness of individual sand packages observed in the logs for wells that penetrate the Meganos Channel fill near the site (e.g., Klein 1-28 and King Island 1-28), and at the nearby East Islands gas field (Attachment G). Note that this term is included as a model input in the form of layer transmissivity (aquifer thickness x hydraulic conductivity), so a separate sensitivity analysis for hydraulic conductivity was not conducted.
    - Aquifer thickness = 50 and 100 feet
    - Lateral aquifer dimensions = infinite on all sides or bounded on one side
- Model Grid and Boundary Conditions. The model was set up on a regular orthogonal grid of 100 by 100 nodes over an area of 7 miles by 7 miles, with a node spacing of 361.7 feet. The configuration and coordinates for the Injection/Withdrawal Well and the Image well are shown on Figure A-5.
- Transmissivity. The aquifer was assigned a transmissivity (T) based on the aquifer thickness for each scenario and the mean of permeabilities calculated for the Upper MR2 Sand, the Lower MR2 Sand and Meganos Channel Sand at the East Islands gas field (Attachment G).
    - Transmissivity for aquifer with 50 foot thickness = 850.5 gpd/ft
    - Transmissivity for aquifer with 100 foot thickness = 1,701 gpd/ft.

- Storativity. The aquifer was assigned a specific storage of 1.0 E-06, which is the default value under EPA guidance (Attachment A, Section A.4.1). The storativity was calculated for each scenario by multiplying the specific storage by the aquifer thickness.
- Injection Rate. An injection rate of 179 gallons per minute (gpm) was assigned to the Injection/Withdrawal Well and the image well (when used) based on the calculation discussed in Attachment A, Section A.3. A 76-day injection duration was assumed based on the actual days during which injection and flow is projected to take place (Attachment H).

♀
********** THWELLS - version 4.01 ********** PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

Scenario 1: 50 ft Aquifer Thickness, No Boundary

********** INPUT DATA **********

CONFINED AQUIFER - THEIS EQUATION

TRANSMISSIVITY = 850 [gpd/ft]

STORAGE COEFFICIENT = .00005

REGIONAL FLOW GRADIENT
(positive--downwards--in flow direction) = 0

REGIONAL FLOW DIRECTION
(horizontal angle in degrees
counter-clockwise from positive x-axis) = 0

REGIONAL FLOW OFFSET AT ORIGIN
(positive in downwards direction) = 0 [ft]

♀

♀
********** THWELLS - version 4.01 ********** PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

Scenario 2: 50 ft Aquifer Thickness, Fault Boundary

********** INPUT DATA **********

CONFINED AQUIFER - THEIS EQUATION

TRANSMISSIVITY = 850 [gpd/ft]

STORAGE COEFFICIENT = .00005

REGIONAL FLOW GRADIENT
(positive--downwards--in flow direction) = 0

REGIONAL FLOW DIRECTION
(horizontal angle in degrees
counter-clockwise from positive x-axis) = 0

REGIONAL FLOW OFFSET AT ORIGIN
(positive in downwards direction) = 0 [ft]

♀
********** THWELLS - PAGE 2

PUMPING/INJECTION WELL DATA

WELL NO. 1

X-COORDINATE = 21270 [ft]
Y-COORDINATE = 22305 [ft]
PUMPING/INJECTION RATE = -257895 [gpd]
TIME SINCE START PUMPING/INJECTION = 76 [day]

WELL NO. 2

X-COORDINATE = 19384.5 [ft]
Y-COORDINATE = 14421.1 [ft]
PUMPING/INJECTION RATE = -257895 [gpd]
TIME SINCE START PUMPING/INJECTION = 76 [day]

♀

♀
********** THWELLS - version 4.01 ********** PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

Scenario 3: 100 ft Aquifer Thickness, No Boundary

********** INPUT DATA **********

CONFINED AQUIFER - THEIS EQUATION

TRANSMISSIVITY = 1701 [gpd/ft]

STORAGE COEFFICIENT = .0001

REGIONAL FLOW GRADIENT
(positive--downwards--in flow direction) = 0

REGIONAL FLOW DIRECTION
(horizontal angle in degrees
counter-clockwise from positive x-axis) = 0

REGIONAL FLOW OFFSET AT ORIGIN
(positive in downwards direction) = 0 [ft]

♀
********** THWELLS - PAGE 2

PUMPING/INJECTION WELL DATA

WELL NO. 1

X-COORDINATE = 21270 [ft]
Y-COORDINATE = 22305 [ft]
PUMPING/INJECTION RATE = -257895 [gpd]
TIME SINCE START PUMPING/INJECTION = 76 [day]

♀

♀
********** THWELLS - version 4.01 ********** PAGE 1

CALCULATION OF DRAWDOWN IN A HOMOGENEOUS, ISOTROPIC, CONFINED, LEAKY
CONFINED OR UNCONFINED AQUIFER WITH MULTIPLE PRODUCTION AND INJECTION
WELLS AND UNIFORM REGIONAL FLOW

Scenario 4: 100 ft Aquifer Thickness, Fault Boundary

********** INPUT DATA **********

CONFINED AQUIFER - THEIS EQUATION

TRANSMISSIVITY = 1701 [gpd/ft]

STORAGE COEFFICIENT = .0001

REGIONAL FLOW GRADIENT
(positive--downwards--in flow direction) = 0

REGIONAL FLOW DIRECTION
(horizontal angle in degrees
counter-clockwise from positive x-axis) = 0

REGIONAL FLOW OFFSET AT ORIGIN
(positive in downwards direction) = 0 [ft]

♀
********** THWELLS - PAGE 2

PUMPING/INJECTION WELL DATA

WELL NO. 1

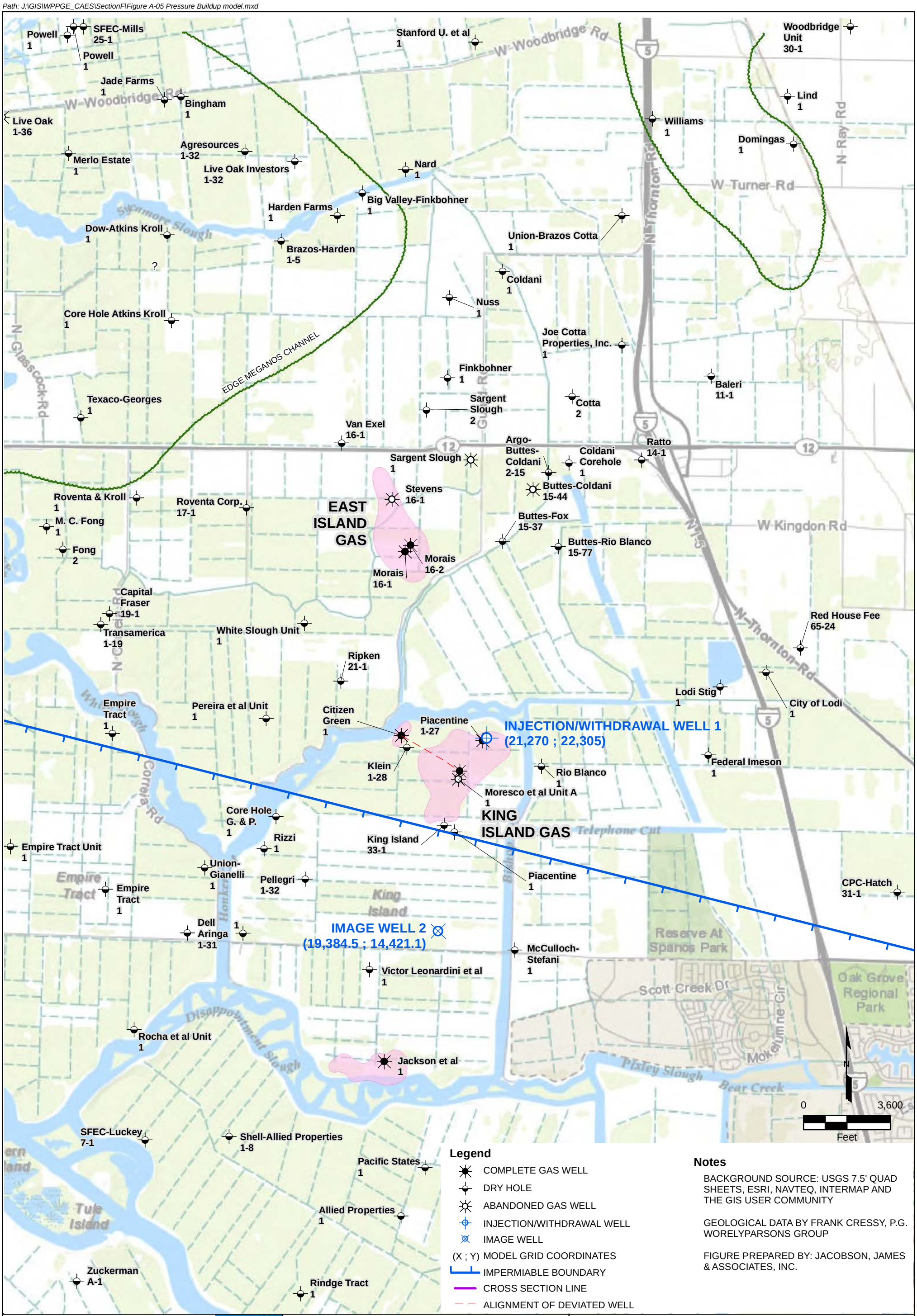
X-COORDINATE = 21270 [ft]
Y-COORDINATE = 22305 [ft]
PUMPING/INJECTION RATE = -257895 [gpd]
TIME SINCE START PUMPING/INJECTION = 76 [day]

WELL NO. 2

X-COORDINATE = 19384.5 [ft]
Y-COORDINATE = 14421.1 [ft]
PUMPING/INJECTION RATE = -257895 [gpd]
TIME SINCE START PUMPING/INJECTION = 76 [day]

♀

Path: J:\GIS\WPPGE_CAES\SectionF\Figure A-05 Pressure Buildup model.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION/WITHDRAWAL WELL
- IMAGE WELL
- (X ; Y) MODEL GRID COORDINATES
- IMPERMIABLE BOUNDARY
- CROSS SECTION LINE
- ALIGNMENT OF DEVIATED WELL

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

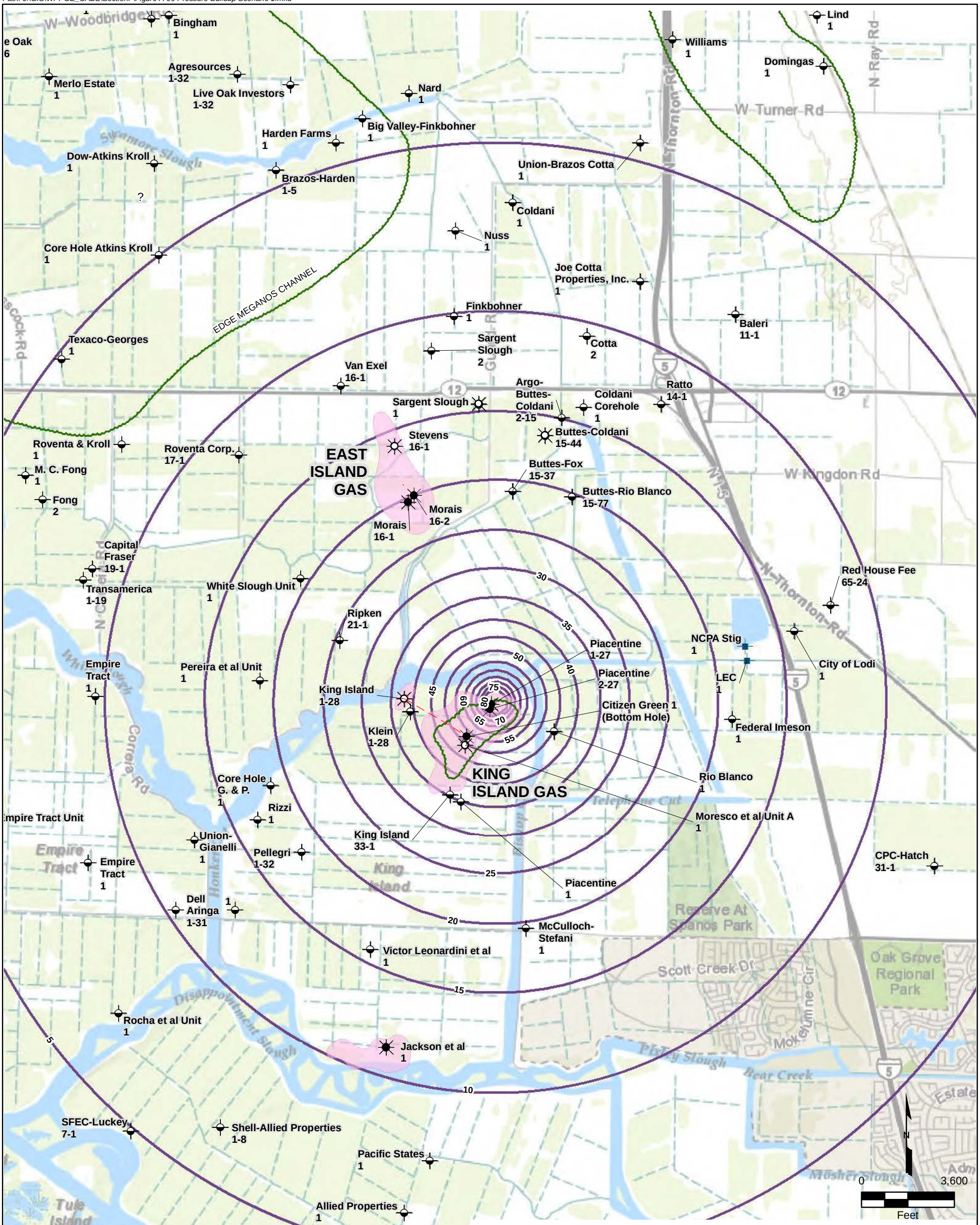
Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/12/13	PEM	RF

CONCEPTUAL MODEL FOR EVALUATION OF PRESSURE BUILDUP IN MEGANOS CHANNEL FILL SANDS

Path: J:\GIS\WPPGE_CAES\SectionF\Figure A-06 Pressure Buildup Scenario 1.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- PREDICTED PRESSURE INCREASE (PSI)
- EDGE OF MEGANOS CHANNEL

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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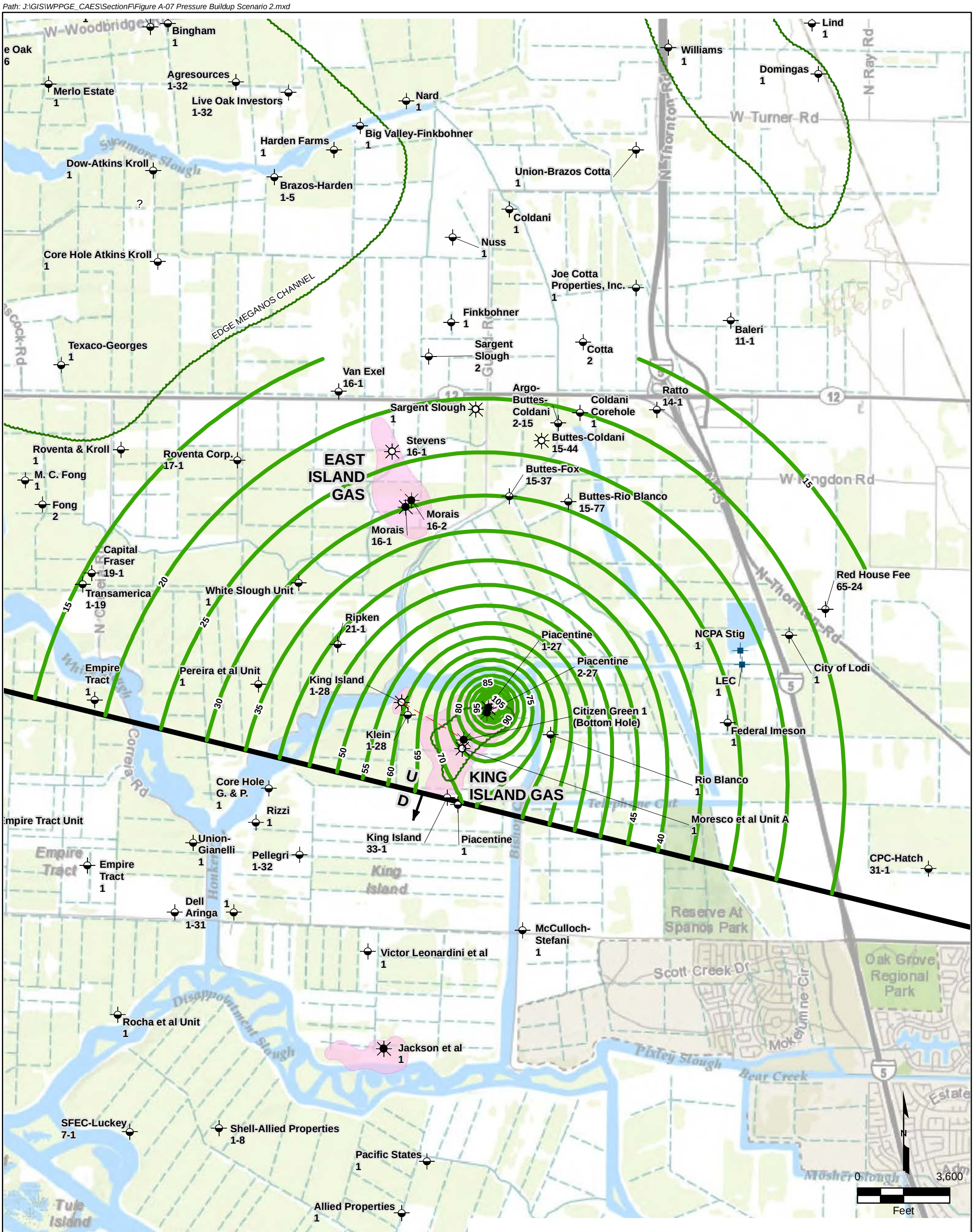
PRESSURE BUILDUP IN MEGANOS CHANNEL SAND SCENARIO 1: 50 FT AQUIFER THICKNESS WITH NO FAULT BOUNDARY

Path: J:\GIS\WPPGE_CAES\SectionF\Figure A-07 Pressure Buildup Scenario 2.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- PREDICTED PRESSURE INCREASE (PSI)
- FAULT
- EDGE OF MEGANOS CHANNEL

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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PROJECT NO.	DATE	DRAWN BY	APPR. BY
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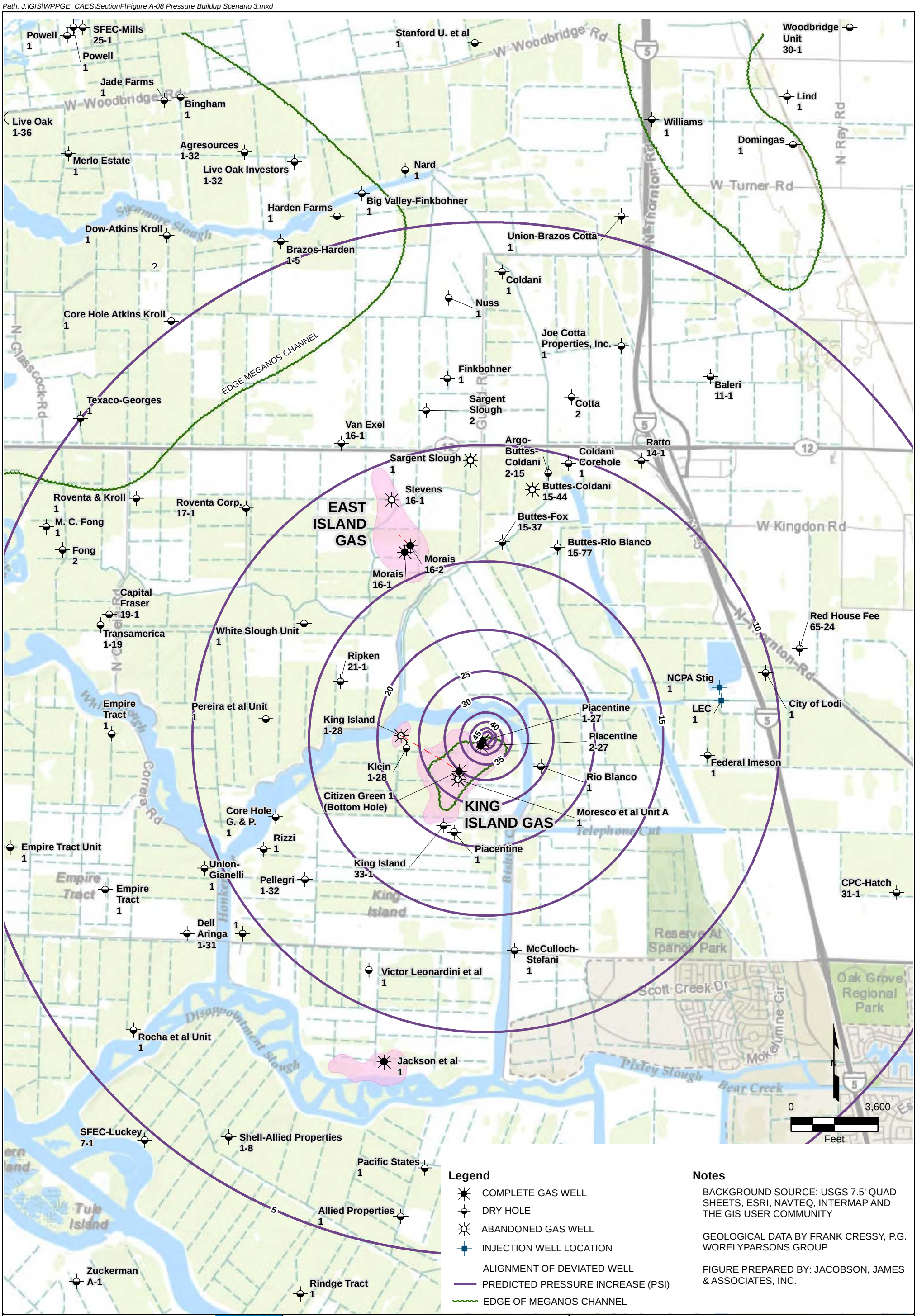
PRESSURE BUILDUP IN MEGANOS CHANNEL SAND SCENARIO 2: 50 FT AQUIFER THICKNESS WITH FAULT BOUNDARY

Path: J:\GIS\WPPGE_CAES\SectionF\Figure A-08 Pressure Buildup Scenario 3.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- PREDICTED PRESSURE INCREASE (PSI)
- EDGE OF MEGANOS CHANNEL

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
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SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPR. BY
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PRESSURE BUILDUP IN MEGANOS CHANNEL SAND SCENARIO 3: 100FT AQUIFER THICKNESS WITH NO FAULT BOUNDARY

Document Path: J:\GIS\WPPGE_CAES\SectionF\Figure A-09 Pressure Buildup Scenario 4.mxd

Powell 1
SFEC-Mills 25-1
Powell 1
Stanford U. et al 1
Woodbridge Unit 30-1
Jade Farms 1
Bingham 1
Lind 1
Live Oak 1-36
Williams 1
Domingas 1
Agresources 1-32
Merlo Estate 1
Live Oak Investors 1-32
Nard 1
Big Valley-Finkbohner 1
Harden Farms 1
Dow-Atkins Kroll 1
Union-Brazos Cotta 1
Brazos-Harden 1-5
Coldani 1
Nuss 1
Core Hole Atkins Kroll 1
Joe Cotta Properties, Inc. 1
EDGE MEGANOS CHANNEL
Finkbohner 1
Baleri 11-1
Texaco-Georges 1
Sargent Slough 2
Cotta 2
Van Exel 16-1
Argo-Buttes-Coldani 2-15
Ratto 14-1
Coldani Corehole 1
Sargent Slough 1
Buttes-Coldani 15-44
Stevens 16-1
Roventa & Kroll 1
Roventa Corp. 17-1
EAST ISLAND GAS
Buttes-Fox 15-37
M. C. Fong 1
Morais 16-2
Buttes-Rio Blanco 15-77
Fong 2
Morais 16-1
Capital Fraser 19-1
Transamerica 1-19
White Slough Unit 1
Red House Fee 65-24
Ripken 21-1
NCPA Stig 1
Empire Tract 1
Pereira et al Unit 1
King Island 1-28
Piacentine 1-27
City of Lodi 1
LEC 1
Piacentine 2-27
Klein 1-28
Federal Imeson 1
Rio Blanco 1
Citizen Green 1 (Bottom Hole)
U
D
KING ISLAND GAS
Moresco et al Unit A 1
Core Hole G. & P. 1
Rizzi 1
Empire Tract Unit 1
Piacentine 1
King Island 33-1
Union-Gianelli 1
Pellegri 1-32
CPC-Hatch 31-1
Empire Tract 1
Dell Aringa 1-31
McCulloch-Stefani 1
Victor Leonardini et al 1
Rocha et al Unit 1
Jackson et al 1
SFEC-Luckey 7-1
Shell-Allied Properties 1-8
Pacific States 1
Allied Properties 1
Zuckerman A-1
Rindge Tract 1

0 3,600 Feet

Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- PREDICTED PRESSURE INCREASE (PSI)
- FAULT
- EDGE OF MEGANOS CHANNEL

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
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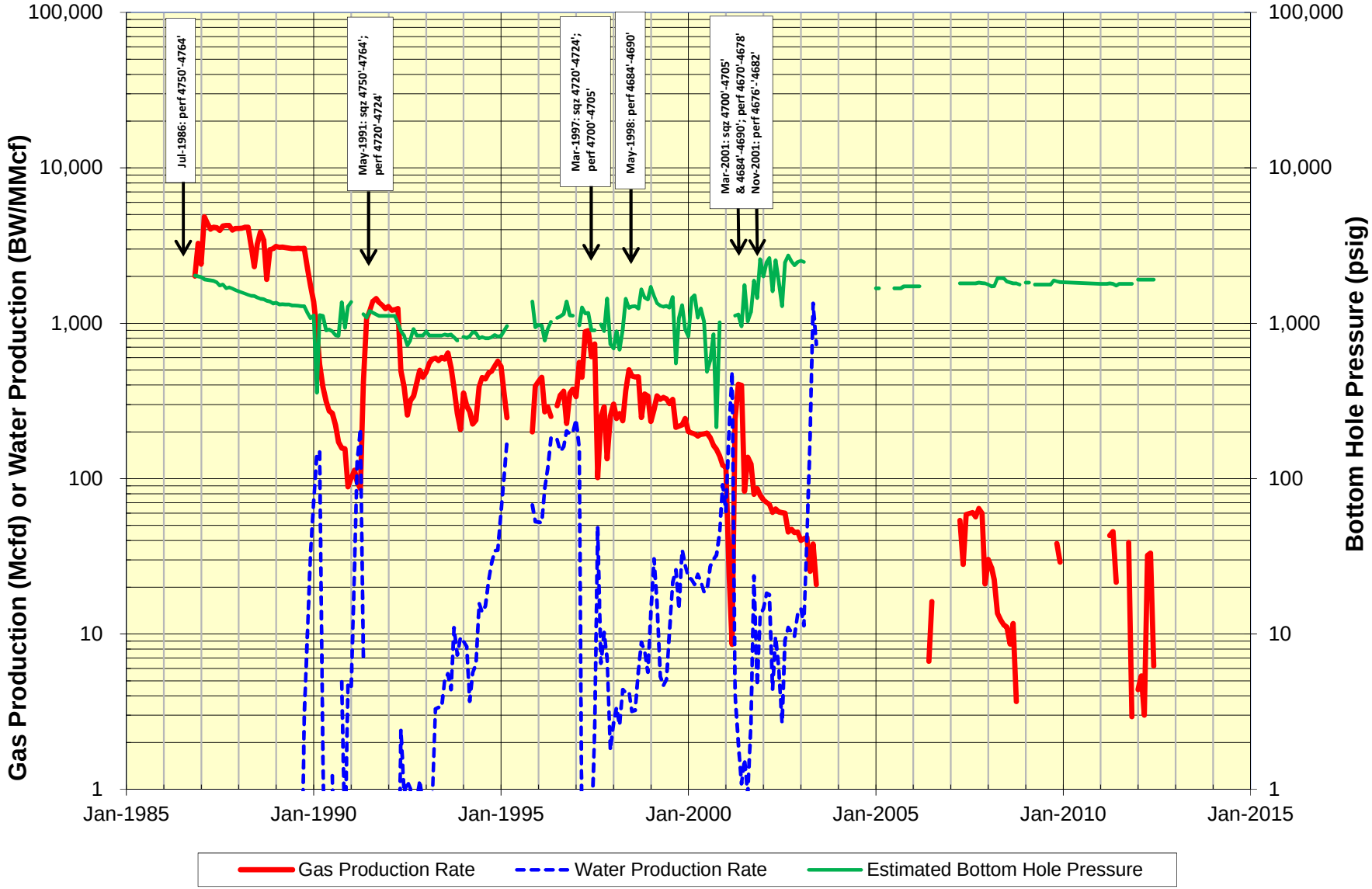
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/31/13	PEM	RF

PRESSURE BUILDUP IN MEGANOS CHANNEL SAND SCENARIO 4: 100FT AQUIFER THICKNESS WITH FAULT BOUNDARY

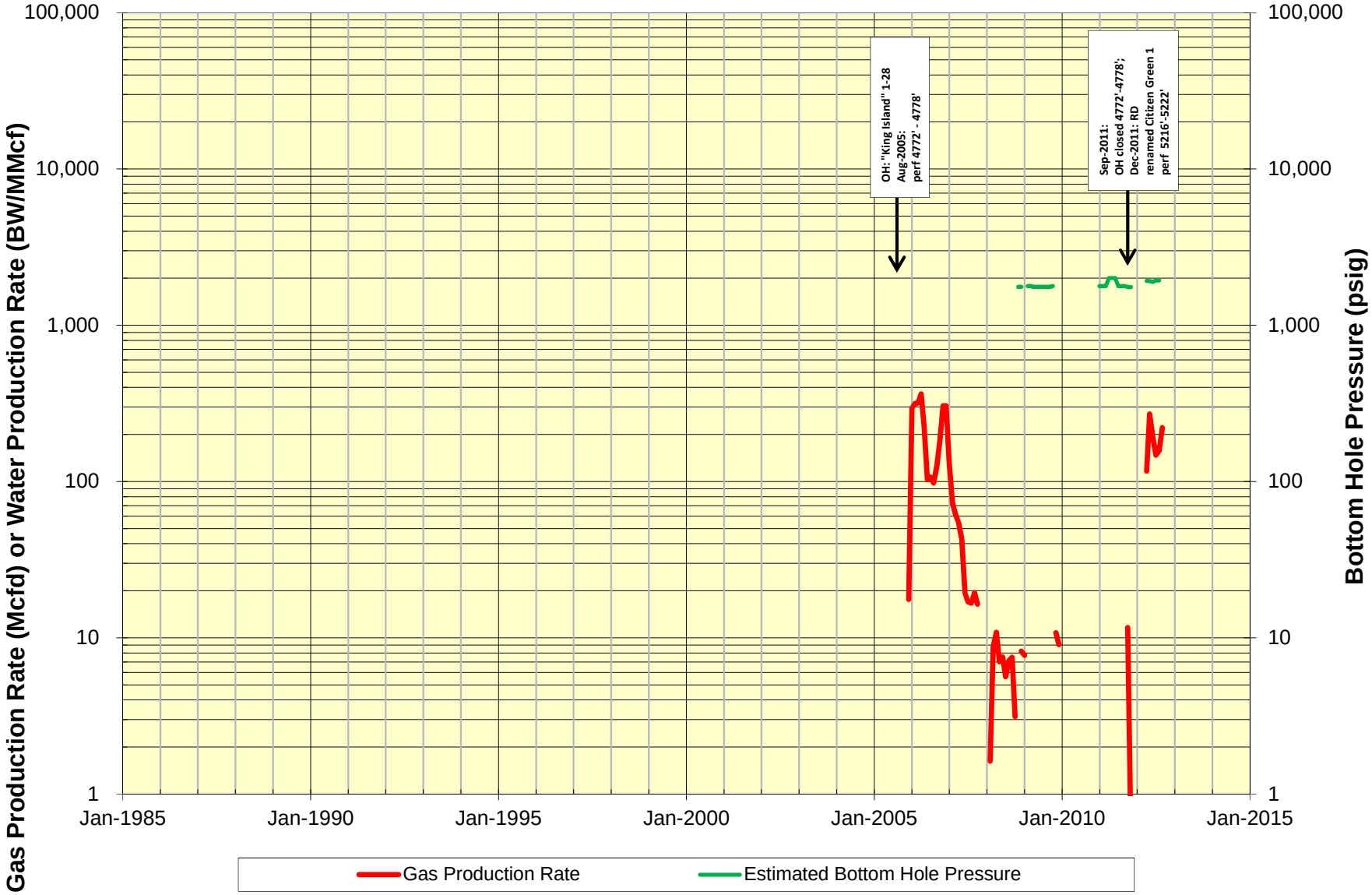
Production Data

Piacentine 1-27 (API 07720484)



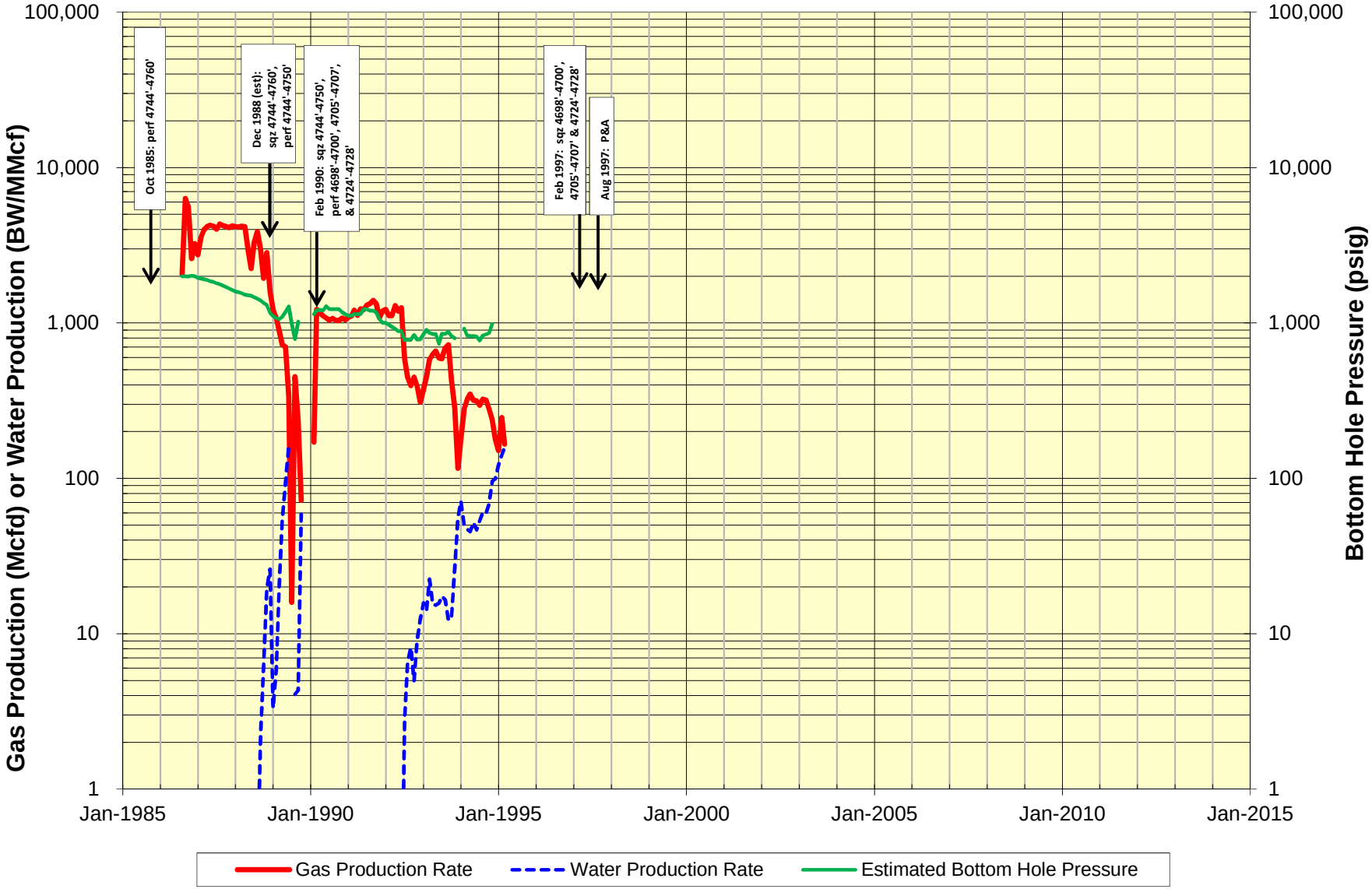
Production Data

Citizen Green 1 (Formerly King Island 1-28) (API 07720688)



Production Data

Moresco et al Unit A 1 (API 07720469)



ATTACHMENT A-5

BOTTOMHOLE PRESSURE MEASUREMENTS

PIACENTINE 1-27 AND CITIZEN GREEN 1

FEBRUARY 12, 2014

P.G.& E.
Daily Report

DATE	12-Feb-14			**REPORT #**	1
LEASE #		**DWC**		**ACT.DAYS**	1
		TWC		**PR. DEPTH**	0
OBJECTIVE FORMATION		**WELL TYPE**	Gas	**LOCATION:**	
WELL NAME	Piacentine #1-27	**CNTY/STATE**	San Joaquin CA	**API #**	
RIG	McAnally Wireline Ser.	**LAST CSG.**		**SET @**	
LAST BOP TEST				**CO. MAN**	Bart Gooding (209) 471-9081

Time	HRS.		OPERATIONS SUMMARY
11:30AM			Checked shut in pressure with digital gauge. S.I.T.P. 1692. S.I.C.P. 1693. R/U McAnally slick line and RIH with 1-1/2" O.D sinker bar and 1-3/4" O.D. Blind Box on bottom of sinker bars to 4674' with no problem. R/U digital pressure guages (2.01') O.D. 1-1/4" in tandem on bottom of sinker bars and RIH and started survey from 4674' 4649' 4624' 4574' 4174' 3174' 2174' 1174' surface. Stopping at each depth and waiting 1 min before moving up the hole. R/D McAnally
1:30PM	2		and moved off.
Tot. Hrs.			

REMARKS:

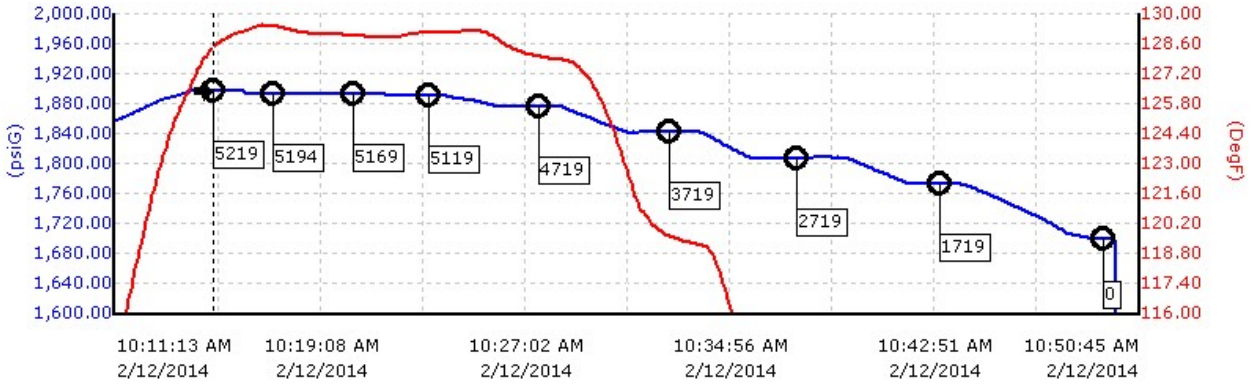
P.G.& E.
Daily Report

DATE	12-Feb-14			**REPORT #**	1
LEASE #		**DWC**		**ACT.DAYS**	1
		TWC		**PR. DEPTH**	0
OBJECTIVE FORMATION		**WELL TYPE**	Gas	**LOCATION:**	
WELL NAME	Citizen Green #1	**CNTY/STATE**	San Joaquin CA	**API #**	
RIG	McAnally Wireline Ser.	**LAST CSG.**		**SET @**	
LAST BOP TEST				**CO. MAN**	Bart Gooding (209) 471-9081

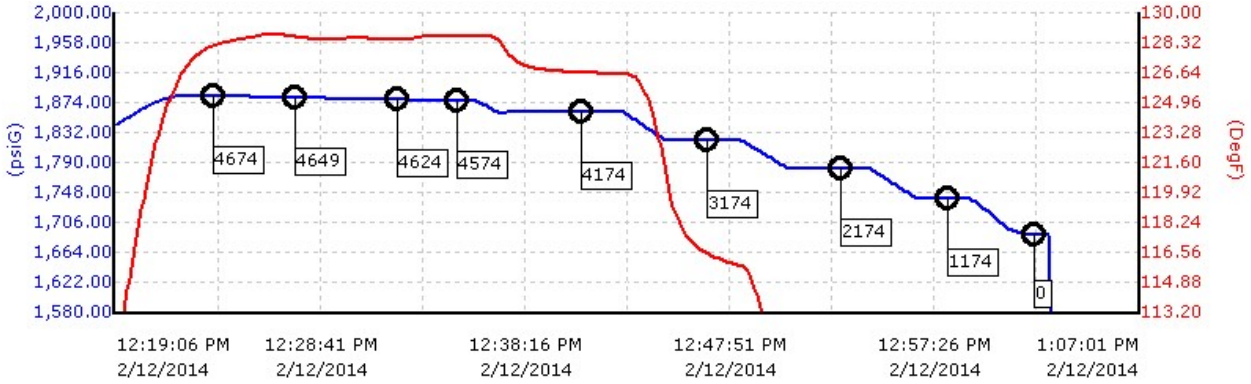
Time	HRS.		OPERATIONS SUMMARY
8:00AM			Checked shut in pressure with digital gauge. S.I.T.P. 1810. S.I.C.P. 1810. R/U McAnally slick line and RIH with 1-1/2" O.D sinker bar and 1-3/4" O.D. Blind Box on bottom of sinker bars to 5219' with no problem. R/U digital pressure guages (2.01') O.D. 1-1/4" in tandem on bottom of sinker bars and RIH and started survey from 5219'-5194' 5169' 5119' 4719' 3719' 2719' 1719' surface. Stopping at each depth and waiting 1 min before moving up the hole. R/D McAnally
10:30AM	2.5		and moved off. Called Gaines Well Ser. To put well back on.
Tot. Hrs.			

REMARKS:

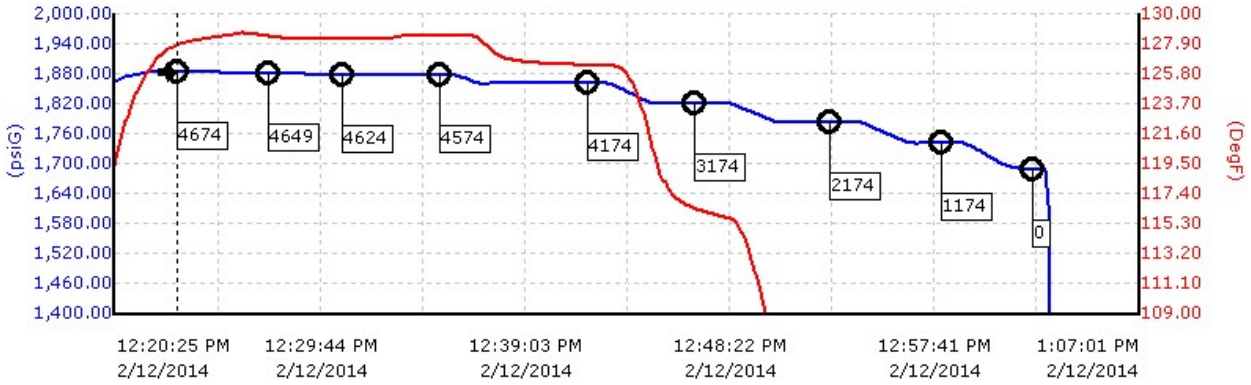
Citizen Green 1 Downhole Pressure Measurements – 1084



Piacentine 1-27 Downhole Pressure Measurements – 1084



Piacentine 1-27 Downhole Pressure Measurements – 1084



Bottomhole pressure survey
Piacentine 1-27
Feb.12,2014
Recorder no. 1084

Gradients:

Depth	Pressure	Pressure Grad	Temp	Temp ft
4674.000	1883.127	0.000	128.183	0.000
4649.000	1880.885	0.090	128.679	-0.020
4624.000	1879.791	0.044	128.542	0.005
4574.000	1877.825	0.039	128.706	-0.003
4174.000	1862.076	0.039	126.677	0.005
3174.000	1822.420	0.040	116.528	0.010
2174.000	1782.418	0.040	100.367	0.016
1174.000	1741.043	0.041	85.196	0.015
0.000	1689.007	0.044	67.257	0.015

Bottomhole pressure survey
Piacentine 1-27
Feb.12,2014
Recorder no. 1085

Gradients:

Depth	Pressure	Pressure Grad	Temp	Temp
4674.000	1883.307	0.000	127.879	0.000
4649.000	1880.790	0.101	128.459	-0.023
4624.000	1879.787	0.040	128.317	0.006
4574.000	1877.786	0.040	128.472	-0.003
4174.000	1862.068	0.039	126.438	0.005
2174.000	1782.578	0.040	100.356	0.016
1174.000	1741.260	0.041	85.196	0.015
0.000	1689.258	0.044	66.897	0.016

Start of job : 2014/02/12 12:00:27 TC: 1
Name of File : C:\pressure\data\140212c.rec
Serial Number:PPI-1084
Piacentine 1-27

Time (Real-Time)	Pressure (psiG)	Temperature (DegF)
2014/02/12 12:00:28	0.195	72.053
2014/02/12 12:00:29	0.193	72.073
2014/02/12 12:00:30	0.172	72.084
2014/02/12 12:00:31	0.174	72.094
2014/02/12 12:00:32	0.002	72.100
2014/02/12 12:00:33	0.169	72.107
2014/02/12 12:00:34	0.157	72.113
2014/02/12 12:00:35	0.174	72.117
2014/02/12 12:00:36	0.157	72.122
2014/02/12 12:00:37	0.155	72.129
2014/02/12 12:00:38	0.152	72.137
2014/02/12 12:00:39	0.147	72.145
2014/02/12 12:00:40	0.141	72.154
2014/02/12 12:00:41	0.134	72.164
2014/02/12 12:00:42	0.123	72.175
2014/02/12 12:00:43	0.110	72.188
2014/02/12 12:00:44	0.095	72.203
2014/02/12 12:00:45	0.082	72.219
2014/02/12 12:00:46	0.071	72.237
2014/02/12 12:00:47	0.061	72.256
2014/02/12 12:00:48	0.053	72.276
2014/02/12 12:00:49	0.047	72.297
2014/02/12 12:00:50	0.042	72.320
2014/02/12 12:00:51	0.041	72.345
2014/02/12 12:00:52	0.041	72.375
2014/02/12 12:00:53	0.043	72.409
2014/02/12 12:00:54	0.045	72.448
2014/02/12 12:00:55	0.047	72.492
2014/02/12 12:00:56	0.049	72.542
2014/02/12 12:00:57	0.051	72.598
2014/02/12 12:00:58	0.052	72.658
2014/02/12 12:01:06	0.053	72.723
2014/02/12 12:01:11	0.051	72.788
2014/02/12 12:01:16	0.048	72.851
2014/02/12 12:01:21	0.046	72.910
2014/02/12 12:01:26	0.043	72.963
2014/02/12 12:01:31	0.040	73.010
2014/02/12 12:01:36	0.039	73.050
2014/02/12 12:01:41	0.039	73.083
2014/02/12 12:01:46	0.042	73.109
2014/02/12 12:01:51	0.046	73.128
2014/02/12 12:01:56	0.055	73.142
2014/02/12 12:02:01	0.065	73.152
2014/02/12 12:02:06	0.078	73.159
2014/02/12 12:02:11	0.093	73.165
2014/02/12 12:02:16	0.110	73.169
2014/02/12 12:02:21	0.126	73.171
2014/02/12 12:02:26	0.139	73.173
2014/02/12 12:02:31	0.150	73.174
2014/02/12 12:02:36	0.159	73.175
2014/02/12 12:02:41	0.165	73.175
2014/02/12 12:02:46	0.168	73.176
2014/02/12 12:02:51	0.168	73.176
2014/02/12 12:02:56	0.166	73.177
2014/02/12 12:03:01	0.160	73.179
2014/02/12 12:03:06	0.155	73.182

2014/02/12 12:03:11	0.149	73.186
2014/02/12 12:03:16	0.144	73.189
2014/02/12 12:03:21	0.138	73.194
2014/02/12 12:03:26	0.133	73.198
2014/02/12 12:03:31	0.128	73.203
2014/02/12 12:03:36	0.124	73.207
2014/02/12 12:03:41	0.120	73.210
2014/02/12 12:03:46	0.117	73.213
2014/02/12 12:03:51	0.114	73.215
2014/02/12 12:03:56	0.111	73.215
2014/02/12 12:04:01	0.109	73.215
2014/02/12 12:04:06	0.107	73.213
2014/02/12 12:04:11	0.105	73.210
2014/02/12 12:04:16	0.103	73.207
2014/02/12 12:04:21	0.101	73.202
2014/02/12 12:04:26	0.099	73.197
2014/02/12 12:04:31	0.097	73.191
2014/02/12 12:04:36	0.095	73.184
2014/02/12 12:04:41	0.094	73.177
2014/02/12 12:04:46	0.092	73.170
2014/02/12 12:04:51	0.091	73.162
2014/02/12 12:04:56	0.089	73.154
2014/02/12 12:05:01	0.087	73.146
2014/02/12 12:05:06	0.080	73.139
2014/02/12 12:05:11	0.094	73.131
2014/02/12 12:05:16	0.110	73.123
2014/02/12 12:05:21	0.140	73.115
2014/02/12 12:05:26	0.138	73.107
2014/02/12 12:05:31	0.190	73.088
2014/02/12 12:05:36	0.114	73.083
2014/02/12 12:05:41	0.108	73.072
2014/02/12 12:05:46	28.478	72.833
2014/02/12 12:05:51	39.582	72.826
2014/02/12 12:05:56	43.665	72.821
2014/02/12 12:06:01	48.360	72.820
2014/02/12 12:06:06	66.546	72.832
2014/02/12 12:06:11	82.292	72.840
2014/02/12 12:06:16	100.009	72.852
2014/02/12 12:06:21	122.819	72.880
2014/02/12 12:06:26	152.598	72.919
2014/02/12 12:06:31	183.237	72.971
2014/02/12 12:06:36	218.208	73.048
2014/02/12 12:06:41	249.326	73.126
2014/02/12 12:06:46	283.926	73.226
2014/02/12 12:06:51	332.237	73.358
2014/02/12 12:06:56	381.517	73.488
2014/02/12 12:07:01	445.628	73.631
2014/02/12 12:07:06	514.022	73.754
2014/02/12 12:07:11	599.216	73.859
2014/02/12 12:07:16	681.811	73.943
2014/02/12 12:07:21	765.874	74.020
2014/02/12 12:07:26	899.351	74.101
2014/02/12 12:07:31	1099.346	74.292
2014/02/12 12:07:36	1370.931	74.611
2014/02/12 12:07:41	1628.459	74.966
2014/02/12 12:07:46	1690.241	75.179
2014/02/12 12:07:51	1689.155	75.454
2014/02/12 12:07:56	1690.368	75.746
2014/02/12 12:08:01	1689.895	76.026
2014/02/12 12:08:06	1690.129	76.279
2014/02/12 12:08:11	1690.599	76.497
2014/02/12 12:08:16	1689.933	76.678
2014/02/12 12:08:21	1690.740	76.819

2014/02/12 12:08:26	1690.316	76.831
2014/02/12 12:08:31	1690.484	76.935
2014/02/12 12:08:36	1690.523	76.948
2014/02/12 12:08:41	1690.465	76.956
2014/02/12 12:08:46	1690.613	77.023
2014/02/12 12:08:51	1690.508	76.990
2014/02/12 12:08:56	1690.547	77.006
2014/02/12 12:09:01	1690.544	76.968
2014/02/12 12:09:06	1690.454	76.971
2014/02/12 12:09:11	1690.664	76.921
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2014/02/12 12:09:21	1690.628	76.822
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Start of job : 2014/02/12 12:00:27 TC: 1
Name of File : C:\pressure\data\140212d.rec
Serial Number:PPI-1085
Piacentine 1-27

Time (Real-Time)	Pressure (psiG)	Temperature (DegF)
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2014/02/12 12:36:46	1865.587	128.497
2014/02/12 12:36:51	1864.178	128.450
2014/02/12 12:36:56	1862.792	128.389
2014/02/12 12:37:01	1861.422	128.311
2014/02/12 12:37:06	1860.036	128.218
2014/02/12 12:37:11	1858.932	128.111
2014/02/12 12:37:16	1859.258	127.993
2014/02/12 12:37:21	1860.467	127.865
2014/02/12 12:37:26	1861.390	127.732
2014/02/12 12:37:31	1861.847	127.598
2014/02/12 12:37:36	1861.971	127.470
2014/02/12 12:37:41	1861.932	127.352
2014/02/12 12:37:46	1861.974	127.247
2014/02/12 12:37:51	1861.995	127.158
2014/02/12 12:37:56	1861.994	127.082
2014/02/12 12:38:01	1862.061	127.024
2014/02/12 12:38:06	1862.029	126.997
2014/02/12 12:38:11	1862.043	126.952
2014/02/12 12:38:16	1862.047	126.905
2014/02/12 12:38:21	1862.050	126.864
2014/02/12 12:38:26	1862.053	126.828
2014/02/12 12:38:31	1862.056	126.797
2014/02/12 12:38:36	1862.058	126.770
2014/02/12 12:38:41	1862.060	126.747
2014/02/12 12:38:46	1862.062	126.726
2014/02/12 12:38:51	1862.063	126.707
2014/02/12 12:38:56	1862.064	126.690
2014/02/12 12:39:01	1862.065	126.675
2014/02/12 12:39:06	1862.066	126.661
2014/02/12 12:39:11	1862.066	126.648
2014/02/12 12:39:16	1862.067	126.636
2014/02/12 12:39:21	1862.067	126.625
2014/02/12 12:39:26	1862.067	126.614
2014/02/12 12:39:31	1862.066	126.604
2014/02/12 12:39:36	1862.066	126.595
2014/02/12 12:39:41	1862.067	126.586
2014/02/12 12:39:46	1862.067	126.578

2014/02/12 12:39:51	1862.067	126.570
2014/02/12 12:39:56	1862.067	126.563
2014/02/12 12:40:01	1862.067	126.555
2014/02/12 12:40:06	1862.067	126.548
2014/02/12 12:40:11	1862.067	126.542
2014/02/12 12:40:16	1862.067	126.535
2014/02/12 12:40:21	1862.067	126.529
2014/02/12 12:40:26	1862.067	126.523
2014/02/12 12:40:31	1862.067	126.517
2014/02/12 12:40:36	1862.067	126.511
2014/02/12 12:40:41	1862.067	126.506
2014/02/12 12:40:46	1862.067	126.500
2014/02/12 12:40:51	1862.068	126.495
2014/02/12 12:40:56	1862.068	126.490
2014/02/12 12:41:01	1862.068	126.485
2014/02/12 12:41:06	1862.068	126.480
2014/02/12 12:41:11	1862.068	126.475
2014/02/12 12:41:16	1862.068	126.470
2014/02/12 12:41:21	1862.068	126.466
2014/02/12 12:41:26	1862.068	126.462
2014/02/12 12:41:31	1862.068	126.457
2014/02/12 12:41:36	1862.068	126.453
2014/02/12 12:41:41	1862.068	126.449
2014/02/12 12:41:46	1862.068	126.445
2014/02/12 12:41:51	1862.068	126.442
2014/02/12 12:41:56	1862.068	126.438
2014/02/12 12:42:01	1862.068	126.435
2014/02/12 12:42:06	1862.068	126.431
2014/02/12 12:42:11	1862.065	126.428
2014/02/12 12:42:16	1862.057	126.424
2014/02/12 12:42:21	1862.059	126.421
2014/02/12 12:42:26	1862.046	126.418
2014/02/12 12:42:31	1862.038	126.416
2014/02/12 12:42:36	1862.032	126.413
2014/02/12 12:42:41	1862.015	126.409
2014/02/12 12:42:46	1861.986	126.405
2014/02/12 12:42:51	1861.785	126.403
2014/02/12 12:42:56	1860.838	126.398
2014/02/12 12:43:01	1859.532	126.394
2014/02/12 12:43:06	1858.143	126.386
2014/02/12 12:43:11	1856.858	126.373
2014/02/12 12:43:16	1855.315	126.349
2014/02/12 12:43:21	1853.526	126.313
2014/02/12 12:43:26	1851.845	126.259
2014/02/12 12:43:31	1850.177	126.184
2014/02/12 12:43:36	1848.454	126.085
2014/02/12 12:43:41	1846.650	125.960
2014/02/12 12:43:46	1844.883	125.809
2014/02/12 12:43:51	1843.176	125.630
2014/02/12 12:43:56	1841.352	125.422
2014/02/12 12:44:01	1839.670	125.184
2014/02/12 12:44:06	1837.843	124.913
2014/02/12 12:44:11	1836.034	124.610
2014/02/12 12:44:16	1834.235	124.272
2014/02/12 12:44:21	1832.534	123.904
2014/02/12 12:44:26	1830.668	123.507
2014/02/12 12:44:31	1828.974	123.083
2014/02/12 12:44:36	1827.059	122.636
2014/02/12 12:44:41	1825.431	122.170
2014/02/12 12:44:46	1823.618	121.683
2014/02/12 12:44:51	1822.538	121.176
2014/02/12 12:44:56	1821.882	120.661
2014/02/12 12:45:01	1822.412	120.143

2014/02/12 12:45:06	1822.021	119.652
2014/02/12 12:45:11	1822.229	119.210
2014/02/12 12:45:16	1822.356	118.830
2014/02/12 12:45:21	1822.068	118.506
2014/02/12 12:45:26	1822.387	118.303
2014/02/12 12:45:31	1822.298	118.174
2014/02/12 12:45:36	1822.335	117.900
2014/02/12 12:45:41	1822.349	117.723
2014/02/12 12:45:46	1822.369	117.540
2014/02/12 12:45:51	1822.397	117.376
2014/02/12 12:45:56	1822.408	117.240
2014/02/12 12:46:01	1822.425	117.118
2014/02/12 12:46:06	1822.441	117.009
2014/02/12 12:46:11	1822.451	116.912
2014/02/12 12:46:16	1822.464	116.825
2014/02/12 12:46:21	1822.471	116.746
2014/02/12 12:46:26	1822.481	116.673
2014/02/12 12:46:31	1822.489	116.606
2014/02/12 12:46:36	1822.494	116.544
2014/02/12 12:46:41	1822.502	116.486
2014/02/12 12:46:46	1822.505	116.431
2014/02/12 12:46:51	1822.511	116.379
2014/02/12 12:46:56	1822.515	116.330
2014/02/12 12:47:01	1822.518	116.283
2014/02/12 12:47:06	1822.522	116.238
2014/02/12 12:47:11	1822.524	116.195
2014/02/12 12:47:16	1822.528	116.154
2014/02/12 12:47:21	1822.530	116.113
2014/02/12 12:47:26	1822.533	116.074
2014/02/12 12:47:31	1822.536	116.037
2014/02/12 12:47:36	1822.538	116.000
2014/02/12 12:47:41	1822.541	115.964
2014/02/12 12:47:46	1822.539	115.929
2014/02/12 12:47:51	1822.533	115.892
2014/02/12 12:47:56	1822.545	115.857
2014/02/12 12:48:01	1822.510	115.825
2014/02/12 12:48:06	1822.538	115.792
2014/02/12 12:48:11	1822.505	115.762
2014/02/12 12:48:16	1822.504	115.731
2014/02/12 12:48:21	1822.488	115.698
2014/02/12 12:48:26	1822.075	115.669
2014/02/12 12:48:31	1820.835	115.635
2014/02/12 12:48:36	1819.216	115.588
2014/02/12 12:48:41	1817.786	115.501
2014/02/12 12:48:46	1816.284	115.365
2014/02/12 12:48:51	1814.759	115.177
2014/02/12 12:48:56	1813.284	114.947
2014/02/12 12:49:01	1811.758	114.678
2014/02/12 12:49:06	1810.281	114.372
2014/02/12 12:49:11	1808.774	114.036
2014/02/12 12:49:16	1807.255	113.670
2014/02/12 12:49:21	1805.818	113.281
2014/02/12 12:49:26	1804.297	112.868
2014/02/12 12:49:31	1802.749	112.439
2014/02/12 12:49:36	1801.355	111.992
2014/02/12 12:49:41	1799.709	111.532
2014/02/12 12:49:46	1798.377	111.058
2014/02/12 12:49:51	1796.826	110.572
2014/02/12 12:49:56	1795.271	110.074
2014/02/12 12:50:01	1793.862	109.566
2014/02/12 12:50:06	1792.252	109.049
2014/02/12 12:50:11	1790.788	108.523
2014/02/12 12:50:16	1789.223	107.987

2014/02/12 12:50:21	1787.836	107.445
2014/02/12 12:50:26	1786.245	106.896
2014/02/12 12:50:31	1784.720	106.343
2014/02/12 12:50:36	1783.244	105.786
2014/02/12 12:50:41	1782.186	105.226
2014/02/12 12:50:46	1782.220	104.667
2014/02/12 12:50:51	1782.426	104.122
2014/02/12 12:50:56	1782.194	103.612
2014/02/12 12:51:01	1782.479	103.159
2014/02/12 12:51:06	1782.238	102.769
2014/02/12 12:51:11	1782.348	102.461
2014/02/12 12:51:16	1782.420	102.328
2014/02/12 12:51:21	1782.409	102.138
2014/02/12 12:51:26	1782.434	101.904
2014/02/12 12:51:31	1782.453	101.702
2014/02/12 12:51:36	1782.471	101.529
2014/02/12 12:51:41	1782.488	101.382
2014/02/12 12:51:46	1782.501	101.255
2014/02/12 12:51:51	1782.515	101.146
2014/02/12 12:51:56	1782.523	101.051
2014/02/12 12:52:01	1782.532	100.967
2014/02/12 12:52:06	1782.539	100.892
2014/02/12 12:52:11	1782.544	100.825
2014/02/12 12:52:16	1782.551	100.764
2014/02/12 12:52:21	1782.555	100.707
2014/02/12 12:52:26	1782.559	100.655
2014/02/12 12:52:31	1782.563	100.606
2014/02/12 12:52:36	1782.566	100.559
2014/02/12 12:52:41	1782.569	100.515
2014/02/12 12:52:46	1782.571	100.473
2014/02/12 12:52:51	1782.574	100.433
2014/02/12 12:52:56	1782.576	100.394
2014/02/12 12:53:01	1782.578	100.356
2014/02/12 12:53:06	1782.580	100.320
2014/02/12 12:53:11	1782.581	100.284
2014/02/12 12:53:16	1782.583	100.250
2014/02/12 12:53:21	1782.584	100.216
2014/02/12 12:53:26	1782.586	100.182
2014/02/12 12:53:31	1782.587	100.150
2014/02/12 12:53:36	1782.589	100.118
2014/02/12 12:53:41	1782.590	100.087
2014/02/12 12:53:46	1782.589	100.056
2014/02/12 12:53:51	1782.584	100.025
2014/02/12 12:53:56	1782.590	99.993
2014/02/12 12:54:01	1782.567	99.964
2014/02/12 12:54:06	1782.581	99.935
2014/02/12 12:54:11	1782.555	99.907
2014/02/12 12:54:16	1782.557	99.879
2014/02/12 12:54:21	1782.543	99.852
2014/02/12 12:54:26	1782.339	99.823
2014/02/12 12:54:31	1781.855	99.795
2014/02/12 12:54:36	1780.457	99.758
2014/02/12 12:54:41	1779.102	99.694
2014/02/12 12:54:46	1777.121	99.581
2014/02/12 12:54:51	1775.771	99.411
2014/02/12 12:54:56	1773.975	99.185
2014/02/12 12:55:01	1772.382	98.912
2014/02/12 12:55:06	1770.977	98.595
2014/02/12 12:55:11	1769.131	98.245
2014/02/12 12:55:16	1767.643	97.863
2014/02/12 12:55:21	1765.984	97.456
2014/02/12 12:55:26	1764.429	97.025
2014/02/12 12:55:31	1762.851	96.575

2014/02/12 12:55:36	1761.105	96.108
2014/02/12 12:55:41	1759.514	95.623
2014/02/12 12:55:46	1757.839	95.125
2014/02/12 12:55:51	1756.241	94.614
2014/02/12 12:55:56	1754.759	94.088
2014/02/12 12:56:01	1753.043	93.556
2014/02/12 12:56:06	1751.414	93.018
2014/02/12 12:56:11	1749.817	92.471
2014/02/12 12:56:16	1748.186	91.923
2014/02/12 12:56:21	1746.541	91.369
2014/02/12 12:56:26	1744.904	90.813
2014/02/12 12:56:31	1743.224	90.255
2014/02/12 12:56:36	1741.667	89.695
2014/02/12 12:56:41	1741.071	89.135
2014/02/12 12:56:46	1741.062	88.580
2014/02/12 12:56:51	1741.206	88.050
2014/02/12 12:56:56	1740.921	87.575
2014/02/12 12:57:01	1741.216	87.169
2014/02/12 12:57:06	1741.124	86.831
2014/02/12 12:57:11	1741.169	86.574
2014/02/12 12:57:16	1741.163	86.530
2014/02/12 12:57:21	1741.173	86.289
2014/02/12 12:57:26	1741.191	86.082
2014/02/12 12:57:31	1741.204	85.905
2014/02/12 12:57:36	1741.218	85.755
2014/02/12 12:57:41	1741.230	85.627
2014/02/12 12:57:46	1741.237	85.516
2014/02/12 12:57:51	1741.246	85.421
2014/02/12 12:57:56	1741.250	85.337
2014/02/12 12:58:01	1741.256	85.263
2014/02/12 12:58:06	1741.260	85.196
2014/02/12 12:58:11	1741.262	85.135
2014/02/12 12:58:16	1741.266	85.080
2014/02/12 12:58:21	1741.266	85.029
2014/02/12 12:58:26	1741.266	84.980
2014/02/12 12:58:31	1741.258	84.927
2014/02/12 12:58:36	1741.218	84.883
2014/02/12 12:58:41	1741.285	84.843
2014/02/12 12:58:46	1741.213	84.804
2014/02/12 12:58:51	1741.269	84.766
2014/02/12 12:58:56	1741.215	84.729
2014/02/12 12:59:01	1741.195	84.694
2014/02/12 12:59:06	1741.063	84.659
2014/02/12 12:59:11	1739.865	84.622
2014/02/12 12:59:16	1738.498	84.575
2014/02/12 12:59:21	1736.520	84.483
2014/02/12 12:59:26	1735.314	84.328
2014/02/12 12:59:31	1733.502	84.109
2014/02/12 12:59:36	1731.923	83.833
2014/02/12 12:59:41	1730.148	83.511
2014/02/12 12:59:46	1727.961	83.150
2014/02/12 12:59:51	1725.940	82.754
2014/02/12 12:59:56	1723.972	82.326
2014/02/12 13:00:01	1721.885	81.868
2014/02/12 13:00:06	1719.804	81.381
2014/02/12 13:00:11	1717.677	80.867
2014/02/12 13:00:16	1715.518	80.321
2014/02/12 13:00:21	1713.395	79.750
2014/02/12 13:00:26	1711.281	79.150
2014/02/12 13:00:31	1709.248	78.520
2014/02/12 13:00:36	1706.977	77.865
2014/02/12 13:00:41	1704.834	77.190
2014/02/12 13:00:46	1702.664	76.497

2014/02/12 13:00:51	1700.555	75.790
2014/02/12 13:00:56	1698.494	75.065
2014/02/12 13:01:01	1697.252	74.329
2014/02/12 13:01:06	1696.364	73.585
2014/02/12 13:01:11	1695.352	72.850
2014/02/12 13:01:16	1694.431	72.145
2014/02/12 13:01:21	1693.646	71.475
2014/02/12 13:01:26	1692.639	70.846
2014/02/12 13:01:31	1691.877	70.255
2014/02/12 13:01:36	1690.974	69.706
2014/02/12 13:01:41	1690.341	69.195
2014/02/12 13:01:46	1689.904	68.723
2014/02/12 13:01:51	1689.567	68.300
2014/02/12 13:01:56	1689.512	67.924
2014/02/12 13:02:01	1689.305	67.595
2014/02/12 13:02:06	1689.347	67.329
2014/02/12 13:02:11	1689.325	67.125
2014/02/12 13:02:16	1689.258	66.897
2014/02/12 13:02:21	1689.403	66.793
2014/02/12 13:02:26	1689.363	66.741
2014/02/12 13:02:31	1689.454	66.733
2014/02/12 13:02:36	1689.446	66.760
2014/02/12 13:02:41	1689.401	66.816
2014/02/12 13:02:46	1689.421	66.888
2014/02/12 13:02:51	1689.407	66.976
2014/02/12 13:02:56	1618.577	66.961
2014/02/12 13:03:01	905.647	66.544
2014/02/12 13:03:06	416.554	66.733
2014/02/12 13:03:11	194.001	66.420
2014/02/12 13:03:16	87.479	66.154
2014/02/12 13:03:21	36.881	65.746
2014/02/12 13:03:26	7.208	65.261
2014/02/12 13:03:31	0.173	64.659
2014/02/12 13:03:36	0.172	64.289
2014/02/12 13:03:41	0.051	63.781
2014/02/12 13:03:46	0.120	63.351
2014/02/12 13:03:51	0.173	62.996
2014/02/12 13:03:56	0.208	62.722
2014/02/12 13:04:01	0.034	62.516
2014/02/12 13:04:06	0.055	62.376
2014/02/12 13:04:11	0.089	62.482
2014/02/12 13:04:16	0.088	62.358
2014/02/12 13:04:21	0.089	62.266
2014/02/12 13:04:26	0.090	62.204
2014/02/12 13:04:31	0.090	62.167
2014/02/12 13:04:36	0.091	62.150
2014/02/12 13:04:41	0.092	62.151
2014/02/12 13:04:46	0.093	62.167
2014/02/12 13:04:51	0.094	62.193
2014/02/12 13:04:56	0.094	62.230
2014/02/12 13:05:01	0.093	62.273
2014/02/12 13:05:06	0.092	62.323
2014/02/12 13:05:11	0.090	62.378
2014/02/12 13:05:16	0.089	62.436
2014/02/12 13:05:21	0.088	62.496
2014/02/12 13:05:26	0.087	62.557
2014/02/12 13:05:31	0.085	62.620
2014/02/12 13:05:36	0.084	62.683
2014/02/12 13:05:41	0.083	62.747
2014/02/12 13:05:46	0.081	62.810
2014/02/12 13:05:51	0.079	62.872
2014/02/12 13:05:56	0.077	62.933
2014/02/12 13:06:01	0.074	62.994

2014/02/12 13:06:06	0.070	63.052
2014/02/12 13:06:11	0.067	63.109
2014/02/12 13:06:16	0.064	63.165
2014/02/12 13:06:21	0.060	63.219
2014/02/12 13:06:26	0.048	63.287
2014/02/12 13:06:31	0.049	63.324
2014/02/12 13:06:36	0.044	63.363
2014/02/12 13:06:41	0.036	63.406
2014/02/12 13:06:46	0.040	63.460
2014/02/12 13:06:51	0.044	63.520
2014/02/12 13:06:56	0.033	63.584
2014/02/12 13:07:01	0.046	63.644

Bottomhole pressure survey
Well: Citizen Green
Date: Feb.12,2014
Recorder no. 1084

Gradients:

Depth	Pressure	Pressure Grad	Temp	Temp ft
5219.000	1897.462	0.000	128.436	0.000
5194.000	1893.726	0.149	129.456	-0.041
5169.000	1892.809	0.037	129.006	0.018
5119.000	1891.066	0.035	129.146	-0.003
4719.000	1877.110	0.035	128.038	0.003
3719.000	1842.384	0.035	119.624	0.008
2719.000	1808.394	0.034	107.095	0.013
1719.000	1773.358	0.035	93.145	0.014
0.000	1700.007	0.043	67.077	0.015

Bottomhole pressure survey
Well: Citizen Green
Date: Feb.12,2014
Recorder no. 1085

Gradients:

Depth	Pressure	Pressure Grad	Temp	Temp ft
5219.000	1897.557	0.000	128.619	0.000
5194.000	1893.619	0.158	129.039	-0.017
5169.000	1892.725	0.036	128.716	0.013
5119.000	1891.034	0.034	128.997	-0.006
4719.000	1877.093	0.035	127.916	0.003
3719.000	1842.429	0.035	119.416	0.009
2719.000	1808.552	0.034	106.547	0.013
1719.000	1773.530	0.035	93.106	0.013
0.000	1701.106	0.042	68.483	0.014

Start of job : 2014/02/12 09:51:27 TC: 1
Name of File : C:\pressure\data\140212a.rec
Serial Number:PPI-1084
Citizen Green

Time (Real-Time)	Pressure (psiG)	Temperature (DegF)
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2014/02/12 09:51:29	0.128	67.919
2014/02/12 09:51:30	0.028	67.945
2014/02/12 09:51:31	0.143	67.965
2014/02/12 09:51:32	0.043	67.985
2014/02/12 09:51:33	0.168	68.000
2014/02/12 09:51:34	0.152	68.012
2014/02/12 09:51:35	0.100	68.022
2014/02/12 09:51:36	0.097	68.028
2014/02/12 09:51:37	0.096	68.039
2014/02/12 09:51:38	0.096	68.050
2014/02/12 09:51:39	0.098	68.061
2014/02/12 09:51:40	0.097	68.070
2014/02/12 09:51:41	0.094	68.080
2014/02/12 09:51:42	0.090	68.089
2014/02/12 09:51:43	0.085	68.097
2014/02/12 09:51:44	0.080	68.106
2014/02/12 09:51:45	0.075	68.113
2014/02/12 09:51:46	0.069	68.120
2014/02/12 09:51:47	0.064	68.126
2014/02/12 09:51:48	0.058	68.131
2014/02/12 09:51:49	0.052	68.135
2014/02/12 09:51:50	0.048	68.138
2014/02/12 09:51:51	0.045	68.140
2014/02/12 09:51:52	0.042	68.142
2014/02/12 09:51:53	0.041	68.143
2014/02/12 09:51:54	0.040	68.144
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2014/02/12 09:51:56	0.041	68.142
2014/02/12 09:51:57	0.041	68.140
2014/02/12 09:51:58	0.044	68.137
2014/02/12 09:51:59	0.047	68.133
2014/02/12 09:52:06	0.052	68.128
2014/02/12 09:52:11	0.058	68.124
2014/02/12 09:52:16	0.066	68.122
2014/02/12 09:52:21	0.076	68.123
2014/02/12 09:52:26	0.083	68.129
2014/02/12 09:52:31	0.091	68.142
2014/02/12 09:52:36	0.102	68.162
2014/02/12 09:52:41	0.109	68.190
2014/02/12 09:52:46	0.117	68.228
2014/02/12 09:52:51	0.122	68.275
2014/02/12 09:52:56	0.124	68.332
2014/02/12 09:53:01	0.124	68.397
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2014/02/12 09:53:11	0.120	68.551
2014/02/12 09:53:16	0.117	68.638
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2014/02/12 09:53:26	0.105	68.828
2014/02/12 09:53:31	0.098	68.931
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2014/02/12 10:53:26	0.074	61.193
2014/02/12 10:53:31	0.089	61.244
2014/02/12 10:53:36	0.107	61.294
2014/02/12 10:53:41	0.123	61.342
2014/02/12 10:53:46	0.135	61.388
2014/02/12 10:53:51	0.145	61.433
2014/02/12 10:53:56	0.151	61.475
2014/02/12 10:54:01	0.155	61.517
2014/02/12 10:54:06	0.156	61.559
2014/02/12 10:54:11	0.155	61.601
2014/02/12 10:54:16	0.150	61.645
2014/02/12 10:54:21	0.143	61.692
2014/02/12 10:54:26	0.136	61.741
2014/02/12 10:54:31	0.128	61.794
2014/02/12 10:54:36	0.119	61.850
2014/02/12 10:54:41	0.110	61.910
2014/02/12 10:54:46	0.100	61.974
2014/02/12 10:54:51	0.092	62.043
2014/02/12 10:54:56	0.086	62.118
2014/02/12 10:55:01	0.081	62.201
2014/02/12 10:55:06	0.077	62.294
2014/02/12 10:55:11	0.072	62.398
2014/02/12 10:55:16	0.071	62.516
2014/02/12 10:55:21	0.073	62.650
2014/02/12 10:55:26	0.077	62.799
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2014/02/12 10:55:36	0.087	63.143
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2014/02/12 10:55:51	0.092	63.742
2014/02/12 10:55:56	0.093	63.947
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2014/02/12 10:56:16	0.088	64.690
2014/02/12 10:56:21	0.087	64.844
2014/02/12 10:56:26	0.089	64.983
2014/02/12 10:56:31	0.093	65.108
2014/02/12 10:56:36	0.099	65.220
2014/02/12 10:56:41	0.105	65.321
2014/02/12 10:56:46	0.175	65.467
2014/02/12 10:56:51	0.158	65.539
2014/02/12 10:56:56	0.151	65.606
2014/02/12 10:57:01	0.148	65.666

Citizen Green 1084.txt

2014/02/12 10:57:06	0.131	65.720
2014/02/12 10:57:11	0.109	65.774
2014/02/12 10:57:16	0.104	65.834
2014/02/12 10:57:21	0.097	65.895

Start of job : 2014/02/12 09:51:27 TC: 1
Name of File : C:\pressure\data\140212b.rec
Serial Number:PPI-1085
Citizen Green

Time (Real-Time)	Pressure (psiG)	Temperature (DegF)
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2014/02/12 09:51:30	0.188	66.108
2014/02/12 09:51:31	0.175	66.116
2014/02/12 09:51:32	0.199	66.122
2014/02/12 09:51:33	0.152	66.132
2014/02/12 09:51:34	0.151	66.139
2014/02/12 09:51:35	0.155	66.144
2014/02/12 09:51:36	0.121	66.149
2014/02/12 09:51:37	0.113	66.156
2014/02/12 09:51:38	0.103	66.164
2014/02/12 09:51:39	0.094	66.172
2014/02/12 09:51:40	0.085	66.180
2014/02/12 09:51:41	0.078	66.189
2014/02/12 09:51:42	0.071	66.198
2014/02/12 09:51:43	0.066	66.207
2014/02/12 09:51:44	0.062	66.217
2014/02/12 09:51:45	0.059	66.227
2014/02/12 09:51:46	0.056	66.236
2014/02/12 09:51:47	0.054	66.245
2014/02/12 09:51:48	0.051	66.252
2014/02/12 09:51:49	0.050	66.258
2014/02/12 09:51:50	0.049	66.264
2014/02/12 09:51:51	0.049	66.268
2014/02/12 09:51:52	0.051	66.271
2014/02/12 09:51:53	0.054	66.273
2014/02/12 09:51:54	0.058	66.274
2014/02/12 09:51:55	0.062	66.274
2014/02/12 09:51:56	0.068	66.273
2014/02/12 09:51:57	0.076	66.271
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2014/02/12 09:52:26	0.099	66.237
2014/02/12 09:52:31	0.098	66.238
2014/02/12 09:52:36	0.097	66.246
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2014/02/12 09:52:51	0.098	66.343
2014/02/12 09:52:56	0.100	66.406
2014/02/12 09:53:01	0.102	66.485
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2014/02/12 09:53:21	0.115	66.924
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2014/02/12 09:53:36	0.107	67.271
2014/02/12 09:53:41	0.101	67.374
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2014/02/12 09:59:21	1700.749	63.452

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2014/02/12 09:59:56	1700.614	62.736
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2014/02/12 10:17:06	1893.666	129.260
2014/02/12 10:17:11	1893.657	129.251
2014/02/12 10:17:16	1893.651	129.237
2014/02/12 10:17:21	1893.645	129.218
2014/02/12 10:17:26	1893.640	129.197
2014/02/12 10:17:31	1893.635	129.173
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2014/02/12 10:49:26	1700.329	67.028
2014/02/12 10:49:31	1700.321	66.887
2014/02/12 10:49:36	1700.309	66.786
2014/02/12 10:49:41	1700.207	66.720
2014/02/12 10:49:46	1700.116	66.682
2014/02/12 10:49:51	1699.754	66.664
2014/02/12 10:49:56	1130.971	66.096
2014/02/12 10:50:01	451.863	66.175
2014/02/12 10:50:06	186.621	65.789
2014/02/12 10:50:11	70.693	65.476
2014/02/12 10:50:16	23.313	65.031
2014/02/12 10:50:21	0.140	64.519
2014/02/12 10:50:26	0.065	63.997
2014/02/12 10:50:31	0.132	63.359
2014/02/12 10:50:36	0.019	62.787
2014/02/12 10:50:41	0.093	62.294
2014/02/12 10:50:46	0.138	61.884
2014/02/12 10:50:51	0.181	61.548
2014/02/12 10:50:56	0.195	61.285
2014/02/12 10:51:01	0.067	61.369
2014/02/12 10:51:06	0.061	61.151
2014/02/12 10:51:11	0.056	60.971
2014/02/12 10:51:16	0.051	60.827
2014/02/12 10:51:21	0.047	60.713
2014/02/12 10:51:26	0.043	60.624
2014/02/12 10:51:31	0.039	60.556
2014/02/12 10:51:36	0.036	60.506
2014/02/12 10:51:41	0.035	60.470
2014/02/12 10:51:46	0.036	60.447
2014/02/12 10:51:51	0.036	60.434

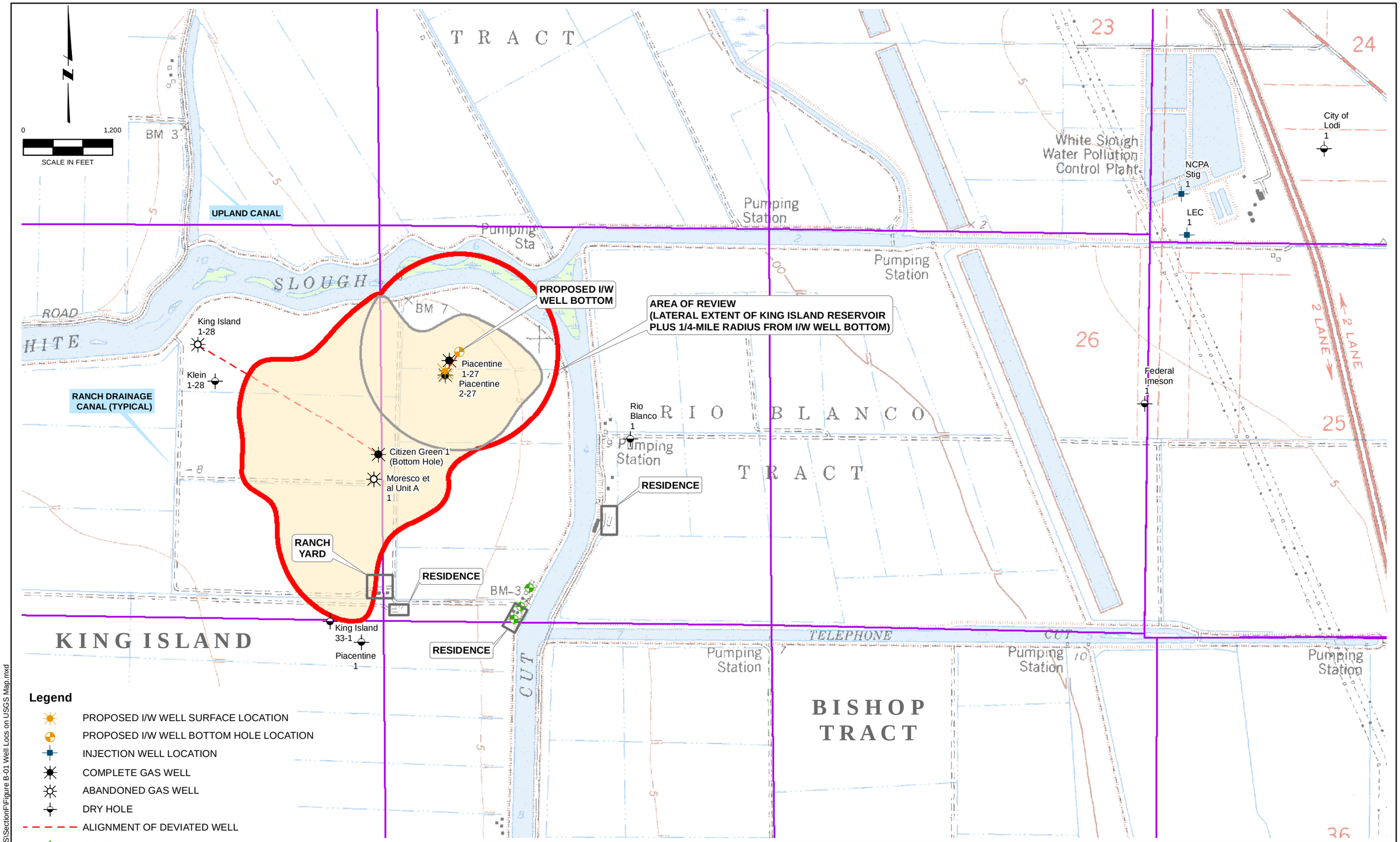
2014/02/12 10:51:56	0.036	60.431
2014/02/12 10:52:01	0.036	60.435
2014/02/12 10:52:06	0.035	60.446
2014/02/12 10:52:11	0.034	60.462
2014/02/12 10:52:16	0.034	60.484
2014/02/12 10:52:21	0.033	60.510
2014/02/12 10:52:26	0.033	60.539
2014/02/12 10:52:31	0.032	60.571
2014/02/12 10:52:36	0.032	60.605
2014/02/12 10:52:41	0.032	60.641
2014/02/12 10:52:46	0.032	60.680
2014/02/12 10:52:51	0.032	60.722
2014/02/12 10:52:56	0.032	60.767
2014/02/12 10:53:01	0.033	60.816
2014/02/12 10:53:06	0.033	60.870
2014/02/12 10:53:11	0.033	60.928
2014/02/12 10:53:16	0.034	60.991
2014/02/12 10:53:21	0.033	61.058
2014/02/12 10:53:26	0.033	61.129
2014/02/12 10:53:31	0.032	61.200
2014/02/12 10:53:36	0.032	61.270
2014/02/12 10:53:41	0.035	61.337
2014/02/12 10:53:46	0.038	61.400
2014/02/12 10:53:51	0.041	61.457
2014/02/12 10:53:56	0.044	61.508
2014/02/12 10:54:01	0.050	61.552
2014/02/12 10:54:06	0.056	61.590
2014/02/12 10:54:11	0.061	61.621
2014/02/12 10:54:16	0.067	61.649
2014/02/12 10:54:21	0.071	61.673
2014/02/12 10:54:26	0.070	61.695
2014/02/12 10:54:31	0.067	61.717
2014/02/12 10:54:36	0.064	61.738
2014/02/12 10:54:41	0.061	61.760
2014/02/12 10:54:46	0.055	61.784
2014/02/12 10:54:51	0.050	61.812
2014/02/12 10:54:56	0.047	61.844
2014/02/12 10:55:01	0.046	61.881
2014/02/12 10:55:06	0.049	61.925
2014/02/12 10:55:11	0.055	61.977
2014/02/12 10:55:16	0.066	62.038
2014/02/12 10:55:21	0.078	62.108
2014/02/12 10:55:26	0.091	62.188
2014/02/12 10:55:31	0.104	62.276
2014/02/12 10:55:36	0.119	62.371
2014/02/12 10:55:41	0.131	62.472
2014/02/12 10:55:46	0.140	62.577
2014/02/12 10:55:51	0.147	62.685
2014/02/12 10:55:56	0.150	62.794
2014/02/12 10:56:01	0.152	62.903
2014/02/12 10:56:06	0.151	63.011
2014/02/12 10:56:11	0.150	63.117
2014/02/12 10:56:16	0.147	63.219
2014/02/12 10:56:21	0.143	63.319
2014/02/12 10:56:26	0.139	63.415
2014/02/12 10:56:31	0.135	63.508
2014/02/12 10:56:36	0.131	63.598
2014/02/12 10:56:41	0.125	63.683
2014/02/12 10:56:46	0.133	63.798
2014/02/12 10:56:51	0.191	63.870
2014/02/12 10:56:56	0.004	63.938
2014/02/12 10:57:01	0.187	64.002
2014/02/12 10:57:06	0.091	64.070

Citizen Green 1085.txt

2014/02/12 10:57:11	0.035	64.134
2014/02/12 10:57:16	0.046	64.197
2014/02/12 10:57:21	0.051	64.275

ATTACHMENT B

Maps of Well/Area of Review



Legend

- PROPOSED I/W WELL SURFACE LOCATION
- PROPOSED I/W WELL BOTTOM HOLE LOCATION
- INJECTION WELL LOCATION
- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- ALIGNMENT OF DEVIATED WELL
- DOMESTIC WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- FARM IRRIGATION/DRAINAGE CANAL
- SECTION LINES

Note

FIGURE PREPARED BY:
JACOBSON, JAMES & ASSOCIATES, INC.

Path: J:\GIS\WPPGE_CAES\Section\Figure B-01 Well Locs on USGS Map.mxd

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT No.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/30/13	PEM	RF

FIGURE B-1

WELL LOCATIONS AND AREA OF REVIEW

ATTACHMENT C

Corrective Action Plan and Well Data

CONTENTS

Section C-1 Requirements

Section C-2 Approach

Section C-3 Identification of Artificial Penetrations in the Area of Review

Section C-4 Corrective Action Evaluation

Section C-5 Corrective Action Plan

Section C-6 References

Table C-1 Completion, Plugging, and Abandonment Details

Table C-2 Summary of Corrective Action Evaluation for Nearby Wells

Figure C-1 Pressure Buildup vs. Distance from Injection Well

Attachment C-1 DOGGR Well Records

C.1 REQUIREMENTS

This section requires evaluation of well completion, plugging and abandonment data for all wells that have the potential to be affected by injection through the proposed Injection/Withdrawal Well within the Area of Review (AOR). The location of these wells is shown on Figure B-1. Table C-1 summarizes the available data for these wells, including the well type, construction data, location, depth, date drilled, and records of plugging and/or completion. If any of these wells is not properly completed, or not plugged and abandoned so as to prevent the migration of injectate through the wellbores into the overlying Underground Sources of Drinking Water (USDW), a corrective action plan must be proposed under 40 CFR 144.55. As provided in 40 CFR 146.7, the following criteria must be considered in determining the need for and adequacy of any corrective action plan:

- Nature and volume of injected fluid (see Attachment H);
- Nature of native fluids or by-products of injection (see Attachment H);
- Potentially affected population (see Attachment D);
- Geology (see Attachments F and G);
- Hydrology (see Attachments D, E and N);
- History of the injection operation (not applicable);
- Completion and plugging records (this attachment);
- Abandonment procedures in effect at the time the well was abandoned (this attachment); and
- Hydraulic connections with USDW (this attachment).

C.2 APPROACH

GENERAL APPROACH

The proposed Injection/Withdrawal well will be used to perform a pilot test in support of a study to evaluate the feasibility of implementing Compressed Air Energy Storage at depleted gas fields. As such, the well will be classified as a Class V Injection Well under the UIC regulations. A UIC Program Guidance memorandum issued by EPA regarding the application of the UIC permitting process to Class V wells for carbon sequestration pilot projects states the following:[1]

> *"Class V experimental technology wells are intended to demonstrate unproven but promising technologies. EPA's rationale for allowing the use of Class V experimental technology wells is to encourage innovation. In other words, under EPA's regulations an*

[1] United States Environmental Protection Agency, 2007. Memorandum from Cynthia C. Dougherty, Director, Office of Groundwater and Drinking Water, to Water Management Division Directors, Regions I through X. Subject: Using the Class V Experimental Well Classification for Pilot Geological Sequestration Projects – UIC Program Guidance (UICPG #83). March 1.

> *injection well that is being used to demonstrate a developing technology may be subject to more flexible, yet fully protective, technical standards than those designed for commercially operating facilities."*

The guidance document goes on to state that

> *"... most pilot projects are assumed to be small enough (low volume and or/use of food-grade CO2) that remediation would not be an issue."*

The proposed CAES feasibility study has been funded by the United States Department of Energy because it is intended to investigate a similar promising technology with potential benefits to decrease greenhouse gas emissions and promote energy independence. Based on this understanding, the approach taken to corrective action evaluation in this attachment is to assess each artificial penetration (deep well) in the Area of Review (AOR) to determine whether there is a credible risk based on the criteria in 40 CFR 146.7. As such, it is intended that the project be fully protective of USDWs. A key aspect of this evaluation is determining whether the well could be a conduit for the flow of injected air, gas, or formation fluids into a USDW. The evaluation identifies wells in the AOR that are not completed or abandoned to EPA standards; however, such wells do not necessarily represent an unacceptable risk or trigger the need for corrective action if adequate protection is in place, based on existing well conditions and the scope and duration of the project.

The above approach based on the above-referenced EPA guidance is appropriate because the project is distinctly different from commercial injection projects and entails lower risk to a USDW, as summarized below.

- The project is a short-term injection and withdrawal test that will be completed over approximately up to 90 days. Pressure impacts will be short-term based on the existing conditions and computer modeling discussed in Attachment A.
- Air will be injected into a high permeability reservoir with proven seals, as demonstrated by the accumulation of natural gas over millions of years. The volume of air that will be injected is much less than the original volume of gas that was held in the reservoir (approximately 4 %).
- Current pressures in the reservoir are approximately 150 pounds per square inch (psi) below hydrostatic pressures, making the temporary rise in reservoir pressures as a result of the proposed compression test less significant, as discussed in Attachment A.
- The monitoring wells proposed for the project are completed so as to resist potential impacts form pressure buildup. The Piacentine 1-27 well will be fitted with a tubing and packer system with a pressurized annulus, and monitored to assure that fluids do not migrate from the injection zone to a USDW. The recently-installed Piacentine 2-27 well was completed to EPA standards and is cemented to the surface. This well is not perforated and will be used only for wireline logging during the test.

- The medium being injected is air (or oxygen-depleted air), which is non-toxic, and less viscous and more compressible than fluid injectate.

Of importance to the corrective action evaluation in this attachment is the fact that standards for Class V (experimental) injection wells are developed on a case by case basis because the risk posed by a Class V well may be higher or lower than a Class I well, depending on the proposed use of the well.

Based on the above, it does not seem reasonable or warranted to require corrective action for wells that do not pose a direct threat to USDW as a result of the short-term pressure increases resulting from the project. We propose that the need for corrective action should be evaluated based on the actual risk of fluid migration into USDW as a result of the proposed compression test. For this purpose, it is also recognized that the presence of mud in abandoned boreholes, wells or well annular spaces provides superior protection than no sealing materials (i.e., open, water filled spaces). Before evaluating the degree of protection provided by mud plugs, it is instructive to review current agency positions as well as the available and relevant literature regarding this issue.

APPROACH TO HEAVY MUD PLUGS

Oil and gas wells in California are generally completed with annular cement plugs across the producing formations and are plugged and abandoned in similar fashion in order to protect USDW. In addition, drilling mud has historically been used as a reservoir plug when there are no oil or gas shows. In both cases cement plugs are placed at the base of state-defined freshwater resources. Current well abandonment standards applied by the California Department of Oil, Gas and Geothermal Resources (DOGGR) allow the use of mud plugs at the USDW interface. A letter dated May 20, 2010, from the California State Oil and Gas Supervisor to all of the DOGGR district offices, provided standards for its Class II UIC program. Highlighted in these standards is the following excerpt:

> *"Historically, the Division has protected water quality of ~3,000 mg/L TDS or less. This is supported by both the State Water Resources Control Board Resolution No. 88-63 and the Federal aquifer exemption regulations (3,000 mg/L TDS or less is considered a major aquifer exemption). A minor aquifer exemption is required for water quality between 3,000 and 10,000 mg/L TDS. The Divisions construction standards, consisting of the use of casing, mud, and cement, are adequate to prevent fluid migration and the comingling of lesser quality fluids. The hole and casing annulus space, between the top of cement isolating the oil and gas zones and the base of cement covering the BFW interface should have heavy mud to prevent the movement of fluids. Therefore, it is reasonable to conclude that the water quality of 10,000 TDS or less will be protected by the standards that are in place."*
>
> *"Failure to meet any one of these conditions without an appropriate variance indicates non-confinement, which is not allowed."*

In 2011, EPA requisitioned a review of the DOGGR's Class II Underground Injection Control (UIC) program. Horsley Witten Group (2011) issued a Final Report on the review of the UIC program in June

2011, and made specific recommendations regarding the protection of USDW. Below is an excerpt from this report:

> *"In addition, USDWs containing more than 3,000 mg/L TDS are not protected to the extent that fresh water aquifers are protected from inflow of lesser quality waters. Placement of cement plugs is required at the BFW, but not at the base of other USDWs unless those depths happen to be coincident in a well. Protection from fluid movement into and between USDWs below the BFW depends partially on the presence of heavy mud in the casing/wellbore annulus and between cement plugs in the open-hole or inside casing strings. However, USDWs must be isolated from fluid movement exiting the injection zone and hydrocarbon bearing zones, by placement of sufficient cement volumes in the annular space and cement plugs above those zones. The presence of drilling mud may not prevent fluid movement between zones in the uncemented annulus, especially in the older wells within the AOR since the mud will degrade over time and not retain the density and other properties necessary to suppress fluid movement. In our view, cement should be placed at the base of USDWS as it is for the BFW to ensure long term protection from fluid movement into or between USDWs."*

These recommendations highlight EPA's desire to implement uniform well completion and abandonment standards that are protective of USDW.

In order to determine the degree of protection afforded by mud completions or mud plugs above the injection zone, we reviewed available literature regarding the potential degradation in effectiveness or performance of mud plugs over time. The available literature supports the consideration of mud weight and gel strength when evaluating the potential for fluid movement. As indicated below, we were unable to find any specific references regarding the diminishment of mud densities or degradation of other properties necessary to suppress fluid movement in inorganic muds over time.

- Annis (1967) and Barker (1981) indicate that water based muds commonly used in well plugging develop high gel strengths after prolonged periods of quiescence, which may increase indefinitely with time. Additionally, they indicate that mud gel strengths observed in laboratory tests would probably increase under reservoir conditions due to the greater time involved and fluid loss to the formation.
- Davis (1985) and Gray and Darly (1981) identified an increase in mud gel strength with an increase in temperature.
- Johnson (1985) reported that mud in reentered boreholes was found to have thickened to a gel strength greater than that of the original mud conditions. However, no evidence was found that such thickened muds ever solidified completely.

The evidence presented in the literature review supports that heavy drilling mud can provide protection against the inter-formation migration of fluids in boreholes and wells. The use of drilling mud for well plugging relies on the characteristics of mud weight and gel strength to prevent upward flow of reservoir fluids. For upward flow of fluids to occur, the formation fluids must overcome the downward

pressure exerted by the weight of the mud column in the wellbore and the resistance offered by the mud's gel strength. The gel strength of mud is the resistance to shear that develops when the mud is not moving.

Static mud columns exert pressure on the formation. In order for a well to provide a pathway for fluid movement, the induced hydrostatic pressure acting on the mud column must first overcome the static mud column pressure. In addition, the gel strength of the drilling mud must also be considered. This relationship is explained by Davis (1986) as:

$$P_f + P_i > P_s + P_g$$

Where:

P_f = original formation pressure (pounds per square inch [psi])

P_i = formation pressure increase due to injection (psi)

P_s = static mud column pressure (psi)

P_g = gel strength pressure (psi)

Therefore, pressure increase due to injection must be greater than static fluid column pressure minus original formation pressure:

$$P_i > P_s + P_g - P_f$$

Static mud column pressure is calculated using the equation:

$$P_s = 0.052 \times h \times M$$

Where:

P_s = pressure of static mud column (psi)

h = depth to the injection reservoir (feet)

M = fluid mud weight (pounds per gallon) and

0.052 is the conversion factor so that Ps is in psi.

In an artificial penetration filled with a column of drilling mud, the gel strength of the mud must also be considered, as it provides additional resistance to flow. In this case, for upward fluid movement to begin, original formation pressure (P_f) plus the pressure due to injection (P_i) must be greater than the static fluid column pressure plus the gel strength of the mud:

$$P_g = \frac{0.00333 \times G \times h}{F.1 \ d}$$

Where:

P_g = pressure due to gel strength (psi)

G = gel strength (pounds/100 feet^2)

h = depth to the injection reservoir (feet)

d = borehole diameter (inches)

Where 0.00333 is the conversion factor, such that P_g is in psi.

As shown on Figure B-1, four wells have been identified within the AOR that could potentially be affected by pressure increases resulting from injection of air into the King Island gas reservoir sands. These are the only artificial penetrations known to exist within the AOR. To evaluate the potential need for corrective action at these wells, the pressure increase to which these wells could be subjected as a result of the proposed Injection/Withdrawal Well was first evaluated. The construction information and (where applicable) plugging and abandonment data for these wells was then evaluated to determine if the pressure increase could cause mobilization of fluids into overlying USDW. Cementing across the zone of potential pressure increase is considered to provide sufficient protection against the upward movement of fluids in the annular space of completed wells, or in plugged wells or boreholes. The presence of drilling mud is also accounted for in this evaluation as additional potential prevention against potential fluid migration. A factor of safety of 100 psi or more is considered to provide sufficient protection. Finally, the completion of wells perforated in the zone of pressure increase is evaluated to assess the potential that fluids could migrate up the well and out into the overlying USDW.

Completion and abandonment data for the wells within the AOR are summarized in Table C-1. Data for additional nearby wells outside the AOR are also included.

C.3 IDENTIFICATION OF ARTIFICIAL PENETRATIONS IN THE AREA OF REVIEW

A review of public records maintained by the DOGGR was conducted to assess the location and condition of deep wells in the vicinity of the proposed Injection/Withdrawal Well. As shown on Figure C-1, nine wells have been identified within approximately 1-mile from the proposed Injection/Withdrawal Well location. These wells were drilled for gas exploration or production either in the King Island gas reservoir or on the flanks of the erosional remnant of Mokelumne River Formation in which the King Island gas field is located (Attachment G). Completion details for these wells are summarized in Table C-1, and complete well logs, completion details, and histories are included in Attachment C-1.

Of the wells listed, four have been determined to be located within the AOR identified in Attachments A and B and are evaluated in Section C.4 to determine whether corrective actions are required. These include the Piacentine 1-27, Piacentine 2-27, Citizen Green 1 and Moresco et al. Unit A 1 (Moresco)

wells. The remaining wells are outside the AOR and eliminated from further evaluation based on the following findings:

- Rio Blanco 1. This well was drilled as a dry hole and has been plugged and abandoned. It reached total depth in the Meganos Channel fill. It does not penetrate the Mokelumne River Formation and is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- Klein 1-28. This well was drilled as a dry hole and has been plugged and abandoned. It penetrates the Mokelumne River Formation in the lower MR2, stratigraphically below the water-invaded gas reservoir sands (Attachment G). Predicted pressure buildup in the Mokelumne River Formation sands penetrated by this well will be below hydrostatic pressures and will not be sufficient to drive flow upward into a USDW (Contour Plot A-2a in Attachment A-2). In addition, the well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- King Island 1-28. This well was completed as a producing well in a small gas pool within sands of the Meganos Channel fill and has since been plugged and abandoned. Review of production records indicates that the well is completed in a different pressure regime than the main King Island gas field (Attachment G). The well reached total depth in the Meganos Channel fill and does not penetrate the Mokelumne River Formation. The well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- King Island 33-1. This well was drilled as a dry hole and has been plugged and abandoned. It penetrates the Mokelumne River Formation in the shale overlying the upper MR2, stratigraphically below the water-invaded gas reservoir sands (Attachment G). Log interpretation indicates that a wedge of shale associated with the Meganos Channel fill separates this well from the King Island gas reservoir. Predicted pressure buildup in the Mokelumne River Formation sands penetrated by this well will be below hydrostatic pressures and will not be sufficient to drive flow upward into a USDW (Contour Plot A-2a in Attachment A-2). In addition, the well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

- Piacentine 1. This well was drilled as a dry hole and has been plugged and abandoned. It penetrates the Mokelumne River Formation in the upper MR2, stratigraphically below the water-invaded gas reservoir sands (Attachment G). In addition, it is separated from the King Island gas field by the fault mapped between the King Island 33-1 and Piacentine 1. Predicted pressure buildup in the Mokelumne River Formation sands penetrated by this well will be below

hydrostatic pressures and will not be sufficient to drive flow upward into a USDW (Contour Plot A-2a in Attachment A-2). In addition, the well is outside the area where pressures could build up sufficiently to induce vertical flow to a USDW if a sand-on-sand contact existed between the Mokelumne River Formation and sands in the Meganos Channel fill (Attachment A-3).

C.4 CORRECTIVE ACTION EVALUATION

NATURE AND VOLUME OF INJECTED FLUID

As described in Attachment H, approximately 0.5 billion standard cubic feet of oxygen-depleted air will be injected into the water-invaded King Island gas reservoir sands to build a subsurface air bubble for the proposed compression test. Additional ambient air may be injected in a subsequent test if it is determined that it is safe to do so. The final volume of air left in place in the subsurface bubble will depend on the amount of air blown down during Phase 4 and 5 of the test, but will not exceed 0.5 Bscf. Based on the compressibility of air and natural gas and the predicted pressures, an equivalent water injection volume would be approximately 19,600,000 gallons (470,000 rbbl). The displacement will take place over a period of approximately 76 days of injection and flow testing, which would be equivalent to a net average water injection rate of approximately 180 gallons per minute (gpm) (6,200 bbl/day) (see Attachment A, Section A.3). As such, the proposed injection volume is limited and injection will be completed over a relatively limited time frame.

Air and oxygen depleted air are non-toxic and oxygen-depleted air is relatively inert chemically, consisting mostly of nitrogen. Ambient air has the potential to oxidize iron-bearing minerals in subsurface sediments and cause chemical changes that could mobilize trace metals. Given the mineralogy of the Mokelumne River Formation sands and clays, this is not expected to be a significant process in the injection zone or in fluvial, deltaic or marine sediments in the area in general.

NATURE OF NATIVE FLUIDS OR BY-PRODUCTS OF INJECTION

The chemistry of the saline groundwater present in the water-invaded King Island gas reservoir is summarized in Attachment H. Dissolved solids were detected in a sample of formation water collected from the Piacentine 2-27 core well at a concentration of 14,000 milligrams per liter (mg/L) and consisted primarily of sodium chloride (Attachment H-2). No water quality analysis has ever been performed on produced water from either of the production wells (Piacentine 1-27 and Citizen Green 1), and there is no opportunity to obtain a water sample from either of these wells at this time, since the Piacentine 1-27 well is currently shut-in and the Citizen Green 1 well is not producing any water.

The water-invaded sands of the King Island gas reservoir contain trapped native gas and a relatively thin native gas cap is present at the top of the reservoir. A small amount of gas will be entrained in withdrawn air during withdrawal testing. The chemistry of the King Island gas is presented in Attachment H-1.

POTENTIALLY AFFECTED POPULATION

The proposed Injection/Withdrawal well is located in a designated gas field in a sparsely populated rural agricultural area. The area surrounding the test site is zoned AG-40, which is an agricultural designation. The White Slough Water Pollution Control Facility (WSWPCF), a wastewater treatment plant operated by the City of Lodi, is located approximately 2 miles east of the test site, adjacent to the Northern California Power Authority (NCPA) Lodi Power Plant. The incorporated City Limits of Stockton are located approximately 3 miles southeast of the site, near the intersection of 8-Mile Road and Interstate Highway 5.

GEOLOGY

During the Compression Test, air will be injected into permeable sands of the Upper Cretaceous Mokelumne River Formation (described in Attachments F and G) that occur at elevations between approximately -4,675 feet and -4,800 feet subsea. These sands comprise the depleted (water invaded) King Island gas reservoir, which occurs at the top of an elliptical-shaped erosional remnant of upper Mokelumne River Formation, approximately 230 acres in plan view, that is enclosed on all sides by shale of the Paleocene Meganos Channel fill, and capped by the Eocene Capay Shale (Figure 2, Attachment F). The competence of the seal provided by these formations is demonstrated by the accumulation of gas in the reservoir over millions of years and is discussed in Attachment G. The reservoir sands consist of sandstones with a net composite thickness ranging from about 80 to 220 feet in the uppermost Mokelumne River Formation. These deposits are underlain by sands, shales and siltstones and dip slightly to the west. Beneath the shale and siltstone that defines the base of the gas reservoir sands, interbedded sand, mudstone and shale of the Mokelumne River Formation extend for an additional depth of over 1,000 feet and grade vertically downward into the H&T Shale. The sands of the Mokelumne River Formation within the erosional remnant, including those within as well as those underlying the water-invaded gas reservoir, may experience increased pressures as a result of the proposed air injection.

HYDROLOGY

In terms of subsurface hydrology, the sediments in the King Island erosional remnant consist of packages of permeable aquifer sands separated by lower permeability siltstone, mudstone and shale that act as aquitards. Overall, the sand packages decrease in permeability with depth. The gas reservoir at the top of this sequence has been mostly invaded by water, and together with the sands immediately below the original gas-water contact, comprises the uppermost aquifer in this sequence. The average horizontal permeability of sands in the King Island gas reservoir is approximately 807 millidarcies (mD), based on the average of permeability measurements (converted to reservoir confined stress permeability) from laboratory analysis of core samples retrieved from the Piacentine 2-27 core well (Table G-1). The permeability of the sands in the next deeper package (designated herein as MR2) is somewhat lower than the gas reservoir sands (Table G-4). The permeability of sands in the MR3 and upper portion of the

MR4 is approximately 10 to 19 mD (Table G-4). The lower 300 feet of the MR4 generally consists of siltstones, mudstones and shale that effectively form a basal aquitard layer that grades downwards into the H&T Shale. In summary, the MR2, MR3 and upper MR4 sand packages comprise a series of saline aquifers with an attenuated hydraulic connection to each other and to the water-invaded gas reservoir at the top of the structure.

The permeable sands of the Mokelumne River Formation, including the gas reservoir and the underlying saline aquifers, comprise the injection zone that will experience increased pressures as a result of the proposed air injection. As air is injected into the King Island gas reservoir, the displacement of natural gas and water will cause pressures within the water-invaded gas reservoir sands in the uppermost portion of the King Island erosional remnant to increase. Based on the relatively high permeability of these sands, this pressure increase will propagate throughout the reservoir sands relatively rapidly. The increase in pressure will cause water to flow slowly out of the reservoir through the underlying shale and siltstone and into the underlying aquifer sequence. The displacement and outflow of water from the reservoir sands will propagate downwards through the sequence of sandstone aquifers and intervening siltstone and shale aquitards, until it reaches the thick aquitard sequence in the lowermost portion of the Mokelumne River Formation, through which it will propagate laterally. In addition, water flow and pressure will take place laterally in each aquifer until it reaches the relatively impermeable shales deposited at the edge of the Meganos Channel (assuming, as is likely, that these act as barriers to water flow and pressure propagation). Based on this conceptual model, the lateral propagation of pressure associated with the proposed Injection/Withdrawal Well would be limited by the lateral extent of the reservoir and aquifer sands of the King Island erosional remnant, as shown on Figure A-3.

HISTORY OF THE INJECTION OPERATION

No prior injection wells have been used at this site.

COMPLETION AND PLUGGING RECORDS

Completion and plugging records for the wells in the Area of Review are included in Attachment C-1 and summarized in Table C-1. Specific details are discussed in subsequent sections.

ABANDONMENT PROCEDURES IN EFFECT AT THE TIME THE WELL WAS ABANDONED

The wells completed in the King Island gas field were drilled between the mid-1980's and 2013 using modern techniques and equipment and completed in accordance with DOGGR standards. Each of the wells was completed with annular cement plugs above the gas reservoir to prevent the migration of fluids and gas out of this zone, and at the base of fresh water as defined by the state of California. The Piacentine 2-27 and Citizen Green 1 wells were also completed with annular cement across the base of USDW; whereas the Moresco and Piacentine 1-27 wells lack cement seals at this depth. The Moresco well was plugged and abandoned in accordance with DOGGR standards, with a cement plug above the top of the well perforations and the base of fresh water.

STRUCTURAL INTEGRITY OF CEMENT PLUGS BELOW USDW

The structural integrity of an annular cement plug is dependent primarily on its ability to retain a bond with the well casing in a pressurized reservoir. During the 1960's and 1970's, there was considerable investigation into cementing techniques and procedures to prevent leakage due to improper cementing of production casing. This included laboratory testing on the pressure sealing capability of annular cement. As an example, there is an SPE Journal Paper, 903-PA, "Control and Prevention of Inter-Zonal Flow" published in 1965 which performed laboratory testing of annular cement (5 ½" casing in an 8 5/8" chamber that is 48" in length). The results indicated bond failure pressures of 800 to 4,500 psi, depending on the pressure maintained on the cement annulus during the curing process. One of the conclusions of that report was that "[a] pressure of 800 psi was sufficient to cause communication. This test confirms the previous observations that pressures of the order of 1,000 psi are adequate to cause casing-cement bond failure."

In checking the Well Summary Reports for both the Moresco and Piacentine 1-27 wells, the cementing procedures were implemented according to plan. The top of cement for the Moresco well was 4,120 feet, approximately 575 feet above the top of the Mokolumne River Formation (MRF), and the Piacentine 1-27 well top of cement was 4,175 feet, approximately 495 feet above the top of the MRF. Full hydrostatic pressure was maintained on the cement column during the curing process. Records indicate that Casing Bond Logs were run on both wells; however, copies of those logs are not available from the DOGGR database or the field operator. Because these well casings were subsequently perforated and produced for many years, it can be assumed that the operator at the time reviewed the bond logs and assured themselves that the bond was sufficient to prevent leakage from the formation.

Based on the well history, the cementing procedures appear to have been properly executed. Though the well history indicates that a cement bond log was run on this well, a record of the log is not available. Because the well was perforated and used for production for several decades, we conclude that the cement bond log must have indicated a satisfactory bond. Based on this completion history and the indicated research which shows that even a few feet of cement properly placed in the annulus can provide pressure isolation of at least 800 psi, we have concluded that the predicted pressure increases at the Moresco etal Unit "A" #1 and Piacentine #1-27 wells will not cause casing annulus leakage from the MRF due to bond separation during testing.

The resistance of a cement plug to vertical displacement is also a consideration, but only when the plug is of limited vertical extent. Resistance to vertical displacement is a function of the upward force exerted by pressure in the reservoir against the weight of the cement plug, the confining pressure, and the skin friction between the cement plug and the formation. For annular plugs that extend several hundred feet above the reservoir, the upward force exerted by the reservoir pressure (which acts over a very small cross sectional area) is insignificant when compared to the skin friction between the plug and the overlying formations (which acts over a much larger area).

HYDRAULIC CONNECTIONS WITH USDW

A well may be considered to have a hydraulic connection with USDW if pressure in the injection zone builds up sufficiently to overcome the resistance of well completion (or plugging and abandonment) materials and cause vertical flow to occur through the well and into a USDW. In order to evaluate this, the pressure buildup at each of the four wells was evaluated and compared to ability of the well completion and/or plugging and abandonment materials to resist the pressure increase and prevent vertical flow. Pressure buildup was evaluated in a computer simulation model study using the United States Geological Survey (USGS) MODFLOW 2000 modeling code, as discussed in Attachment A, Section A.4.1, and as presented in Attachment A-2. Maximum pressure buildups at the four AOR wells for the six MODFLOW simulation scenarios described in Attachment A (Section A.4, pages A-9 to A-13) are shown graphically on Figure C-1.

The most realistic conservative case among the six simulation scenarios is believed to be the ShKl scenario, because it honors what is known about the effect of trapped gas in the invaded aquifer zone above the original gas-water contact, while at the same time using the more conservative of the two aquitard permeability values. Under this scenario, the short-term pressure increase (above the ambient pressure) at the existing wells that penetrate the gas reservoir sands ranges from 175 psi (14 psi above the normal hydrostatic gradient) at the Moresco A-1, to 250 psi (89 psi above the normal hydrostatic gradient) at Piacentine 1-27 (Attachment A, Table A-4).[2] The ShKl case can be considered a reasonable conservative case to be relied upon for prediction of the maximum anticipated pressure increase in the reservoir.

The worst-case simulation results are from the SlKl scenario. This scenario is not believed to be realistic because the low specific storage scenarios (Sl) neglect the known increase in compressibility of the system resulting from the presence of trapped gas in the reservoir, and the increased compressibility of gas-saturated water; both factors, which if considered, would significantly raise the specific storage. When this is combined with the low permeability scenario (Kl), the combined effect of the two assumptions characterizes the SlKl scenario as a bounding case that represents a potential ceiling for pressure buildup in the reservoir during the compression test, but is not a reliable predictor of actual pressure buildup. The SlKl scenario is included for perspective on the upper bound of possible results. Under this scenario, the model predicts a short-term pressure increase ranging from 389 to 449 psi above ambient pressures at the Moresco A-1 and Piacentine 1-27 wells, respectively (228 to 288 psi above the normal hydrostatic gradient), as shown in Figure C-1. The pressure build-up profiles for the SlKl cases for the AOR wells are provided in Attachment A, Attachment A-2, Graph A-2b.

The duration of these pressure increases is predicted to be relatively limited as pressure equilibrates with the underlying aquifers in the Mokelumne River Formation. The length of time over which pressures diminish to below the normal hydrostatic gradient will be influenced by existing pressure gradients beneath the reservoir sands that were beyond the scope of the modeling study to evaluate; however, the model illustrates that the re-equilibration could occur over a relatively short time period.

[2] See Attachment A, Section A.5 for calculation of hydrostatic pressures at wells that penetrate the King Island reservoir sands.

An evaluation of the well completion and plugging and abandonment materials for each of the four AOR wells compared to the pressure buildup in excess of hydrostatic pressures is presented below in Table C-2.

TABLE C-2 – SUMMARY OF CORRECTIVE ACTION EVALUATION FOR NEARBY WELLS

Well Name	Distance and Direction from I/W Well	Predicted Pressure Increase above Hydrostatic	Depth to Base of USDW (feet)[1]	Status	Corrective Action Analysis
Piacentine 1-27	180 feet SW	F.2 Realistic Conservative Case = 89 psi Worst Case = 288 psi	4,006	Piacentine No. 1-27 was drilled in 1986 to a total depth of 4,900 feet. A 8-5/8" surface casing was cemented to surface at 627 feet. This well penetrated the MRF starting at 4,670 feet. The MRF contained about 112 feet of gross reservoir sand with a gas/water contact at 4,782 feet. A 5-1/2", 15.5#, K-55 casing was run and cemented at 4,900 feet. The top of cement in the annulus is around 4,175 feet. The well was completed as a gas producer in the MRF. The well is still occasionally producing small amounts of gas and will be used as a monitoring well during the proposed compression test. The conversion program for the well is included in Attachment L-3 and a schematic is included in Attachment M-3. Testing and monitoring of the well is described in Attachment P. The well casing will be pressure tested, a packer and tubing assembly will be inserted into the well, and annular pressure monitoring will be conducted to assure that the well casing remains intact during and after the compression test.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. The perforations of the well are isolated inside the 5-1/2" casing of the well and there are approximately 495 feet of cement outside of the casing above the perforations and above the top of the MRF. In addition, cement is present below the perforations. Prior to use of the proposed Injection/Withdrawal Well, the casing of the Piacentine 1-27 will be pressure tested. During and after use of the Injection/Withdrawal Well, the Piacentine 1-27 casing above the perforated zone will be isolated with a tubing and packer system, and the annular pressure will be monitored. There is no potential for cross flow from this well to a USDW. No corrective action is required.
Piacentine 2-27	370 feet SW	F.3 Realistic Conservative Case = 67 psi Worst Case = 273 psi	3,998	Well drilled in 2013 to a total depth of 4,970'. A 9-5/8" surface casing was cemented to surface at 614 feet. This well penetrated the MRF starting at 4,686 feet and the uppermost reservoir sands were shaled-out at this location. The MRF sand contained no commercial gas in this well. A 5-1/2", 15.5#, J-55 casing was run and cemented at 4,969 feet. Top of cement in the annulus is at the surface. This well has not been perforated in the Mokelumne River Formation or any other formations at this time, and is cemented to surface. It will be used as a monitoring well without modification to run wireline logs during the compression test.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. Since there are no perforations in the 5-1/2" casing and the cement outside of the 5-1/2" casing extents to the surface, there is no potential for cross flow from this well to a USDW. No corrective action is required.

Well Name	Distance and Direction from I/W Well	Predicted Pressure Increase above Hydrostatic	Depth to Base of USDW (feet)[1]	Status	Corrective Action Analysis
Citizen Green No. 1	Bottomhole 1,750 feet SW	F.4 Realistic Conservative Case = 17 psi Worst Case = 232 psi	4,008	Well directionally drilled in 2011/2012 to a total measured depth (MD) of 7,570 feet. 8-5/8" surface casing was cemented from 511 feet to surface. MRF sands were encountered at 5,220 feet MD (4,700 feet VD). The MRF contained about 20 vertical feet of gross reservoir sand with a gas/water contact at 5,244 feet MD (4,720 feet VD). 4-1/2", 11.6#, N-80 casing was run and cemented at 5,513 feet MD. The top of cement in the annulus is approximately 3,700 feet. The well was completed as a gas producer. The well is currently producing small amounts of gas.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. The perforations of the Citizen Green No. 1 are isolated inside the 4-1/2" casing and there is a cement plug outside the casing above and below the perforations. The upper cement plug extends from the MRF past the base of USDW. There is no potential for cross flow from this well to a USDW. No corrective action is required.
Moresco Et Al Unit A No. 1	2,060 feet SW	F.5 Realistic Conservative Case = 14 psi Worst Case = 228 psi	3,881	Well drilled in 1985 to a total depth of 6,500 feet and completed to 4,999 feet. A 8-5/8" surface casing was cemented to surface at 723 feet. This well encountered MRF sands starting at depth of 4,695 feet. The MRF contained 84 feet of gross reservoir sand, with a gas/water contact at 4,779 feet. A 5-1/2", 15.5#, K-55 casing was run and cemented at 4,999 feet. The top of cement in the annulus is approximately 4,120 feet. Completed as a gas producer and produced until 1995, when excessive water production killed the well. The well was plugged and abandoned in 1997. Open perforations in the MRF were abandoned with 156 lineal feet of cement placed inside the 5-1/2" casing. The 5-1/2" casing was perforated at 450 feet (below estimated BFW) and the annulus between the 8-5/8" casing and 5-1/2" casing was squeezed with 43 cubic feet of cement. Approximately 260 lineal feet of cement plug was placed above the perforations inside the well at 450 feet. A 30 foot surface plug was put in place, and the abandonment was approved by the DOGGR.	The MRF sands penetrated by this well are predicted to experience pressure buildup as a result of the proposed Injection/Withdrawal Well. The Moresco et al. Unit A No. 1 was completed with 575 feet of cement above the MRF outside of the 5-1/2" casing, and plugged with 156 feet of cement inside the 5-1/2" casing across the perforations. Above the perforations, the well is filled with heavy drilling mud topped by a cement plug from 450 to 190 feet. Below the perforations, the well is mud plugged, but the lower mud is blocked by the cement plug placed opposite the perforations. There is no potential for cross flow from this well to a USDW. No corrective action is required.

Notes:
1. Methods used to calculate the depth to the base of USDW are described in Attachment E.
2. All depths in this table are below Kelly Bushing.

MRF= Mokelumne River Formation

C.5 CORRECTIVE ACTION PLAN

Based on the above analysis, no known wells within the AOR require Corrective Action; therefore, no Corrective Action Plan is required under 40 CFR 144.55.

C.6 REFERENCES

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TABLE C-1
COMPLETION, PLUGGING AND ABANDONMENT DETAILS
PG&E Compressed Air Energy Storage Project
King Island, San Joaquin County, California

Well Name	Date Drilled	Date Abandoned	Location (relative to proposed I/W well bottom hole location)	Elevation	Total Depth (ft-bgs)	Base of Freshwater (ft-bgs)	Casing Intervals	Perforation (ft-bgs)	Perforation Status	Plug Depths (ft-bgs)	Mud Weight (lb/ft^3) [4]	Well Use	Status
Wells within the Area of Review													
Piacentine No. 1-27	7/4/1986	Not Abandoned	180 feet southwest	-6 ft ground, USGS. +7 ft KB.	4900	Around 150	8-5/8 in, 24 lb, J-55, cemented to surface @ 627 ft. 5-1/2 in, 15.5 lb, K-55, cemented at 4900 ft. Top of cement in the annulus is around 4175 ft.	4670-4682, 4684-4690, 4700-4705, 4720-4724, 4750-4764	Open	4690 ft to 4684 ft, 4705 ft to 4700 ft - Cement squeezed; 4724 ft to 4720 ft, 4764 ft to 4750 ft - Cement squeezed, Below bridge plug at 4715 ft. Only 4682 ft-4670 ft is open.	None	Gas Production	Active
Piacentine 2-27	3/11/2013	Not Abandoned	370 feet southwest	-6 ft ground, USGS. +6 ft KB.	4970	Around 150	9-5/8", 36 lb, J-55 cemented to surface at 614 ft. 5-1/2", 15.5 lb, J-55, cemented to surface at 4969 ft.	None yet. Cased hole has yet to be perforated.	None	None. Casing cemented to surface.	None	Exploratory Gas Well	Inactive
Citizen Green No. 1	12/3/2011	Not Abandoned	1750 feet southwest	-6 ft ground, USGS. +6 ft KB. [1]	7570	400	8-5/8 in, 24 lb, J-55, cemented to surface @ 511 ft. 4-1/2 in, 11.6 lb, N-80, cemented at 5513 ft measured depth. Top of cement in the annulus is around 3700 ft.	5216-5222	Open	None. Casing cemented to surface.	None	Gas Production	Active
Morresco Et. Al. Unit A No. 1	9/6/1985	8/7/1997	2060 feet southwest	-8 ft ground, USGS. +3 ft KB.	6500 (effective depth is 4999)	400	8-5/8 in, 24 lb, J-55, cemented to surface @ 723 ft. 5-1/2 in, 15.5 lb, K-55, cemented at 4999 ft. Top of cement in the annulus is 4120 ft.	4698-4700, 4705-4707, 4724-4728, 4744-4760	Plugged	43 ft^3 of cement squeezed at 450 ft. 200 ft^3 of cement plug from 450 ft to 190 ft. Below cement plug from 4758 ft to 4602 ft. Casing cemented to surface. Surface plug from 30 ft to surface.	73 at 4602 ft.	Gas Production	Abandoned
Wells Outside of the Area of Review													
Rio Blanco No. 1	10/14/1972	10/18/1972	2580 feet southeast	-5 ft ground, USGS. +6 ft KB.	5450	523	8-5/8 in, 23 lb, K-55, cemented to surface @ 523 ft.	None, dry hole.	Mud Plugged	Plugged with mud weight to 557 ft. Plugged with cement from 557 ft to 360 ft and from 29 ft to 4 ft. Stub was cut off below surface. A plate was welded on top of sub.	76-78 [5]	Exploratory Gas Well	Abandoned
Klein No. 1-28	6/14/1961	6/19/1961	3300 feet west-southwest	-4 ft ground, USGS. +9.5 ft KB.	5702	Above 500 [2]	7 in, 20 lb, J-55, cemented to surface @ 496 ft. This well was a dry hole.	None, dry hole.	Mud Plugged	Plugged with mud weight to 520 ft. Plugged with cement from 520 ft to 326 ft and from 4 ft to 10 ft. Stub was cut off 4 ft below surface. A plate was welded on top of sub. Casing cemented to surface.	80	Exploratory Gas Well	Abandoned

TABLE C-1
COMPLETION, PLUGGING AND ABANDONMENT DETAILS
PG&E Compressed Air Energy Storage Project
King Island, San Joaquin County, California

Well Name	Date Drilled	Date Abandoned	Location (relative to proposed I/W well bottom hole location)	Elevation	Total Depth (ft-bgs)	Base of Freshwater (ft-bgs)	Casing Intervals	Perforation (ft-bgs)	Perforation Status	Plug Depths (ft-bgs)	Mud Weight (lb/ft^3) [4]	Well Use	Status
King Island No. 1-28	7/21/2005	9/1/2011	3500 feet west	-6 ft ground, USGS. +6 ft KB. [1]	4995	400	8-5/8 in, 24 lb, J-55, cemented to surface @ 511 ft. 4-1/2 in, 10.5 lb, J-55, cemented at 4952 ft. Top of cement in the annulus is around 3900 ft.	4772-4778	Plugged	4888 ft to 4572 ft. Casing cemented to surface. During abandonment, the 4-1/2" casing was cut off at 712 feet and removed. A cement plug was placed on top of the stub from 712 feet to 554 feet and Citizen Green No. 1 was drilled through.	74.8	Gas Production	Abandoned
King Island No.33-1	5/13/2007	5/18/2007	4000 feet south-southwest	-6 ft ground, USGS. +7 ft KB.	5500	400	8-5/8 in, 24 lb, J-55, cemented to surface @ 556 ft. This well was a dry hole.	None, dry hole.	Mud Plugged	Plugged with mud weight to 624 ft. Plugged with cement from 624 ft to 270 ft and from 30 ft to 5 ft. Stub was cut off 5 ft below surface. A plate was welded on top of sub. Casing cemented to surface.	74	Exploratory Gas Well	Abandoned
Piacentine No. 1	7/17/1962	7/31/1962	4100 feet south-southwest	-4 ft ground, USGS. +9.6 ft KB.	10500	Above 400 [3]	9-5/8 in, 36 lb, J-55, cemented to surface @ 863 ft.	None, dry hole.	Mud Plugged	Plugged with mud weight to 950 ft. Plugged with cement from 950 ft to 728 ft and from 10 ft to 5 ft. Stub was cut off 5 ft (bottom of cellar) below surface. A plate was welded on top of sub.	95	Exploratory Gas Well	Abandoned

Notes:
All measurements are made from KB.
DOG = Department of Oil and Gas
ft = foot
ft^3 = cubic foot
ft-bgs = foot below ground surface
in = inch
I/W - Injection/Withdrawl
KB = Kelly Bushing
lb = pound
lb/ft^3 = pound per cubic foot
MDB&M = Mount Diablo Base and Meridian
PG&E = Pacific Gas & Electric Company
ppg = pound per gallon
psig = pound per square inch gauge
USDW = underground source of drinking water
USGS = United States Geologic Survey

1 - In an email from Mike Woods to Patrick Moss in August, 2011, the well was re-surveyed and the ground elevation was determined to be -6.7 feet.

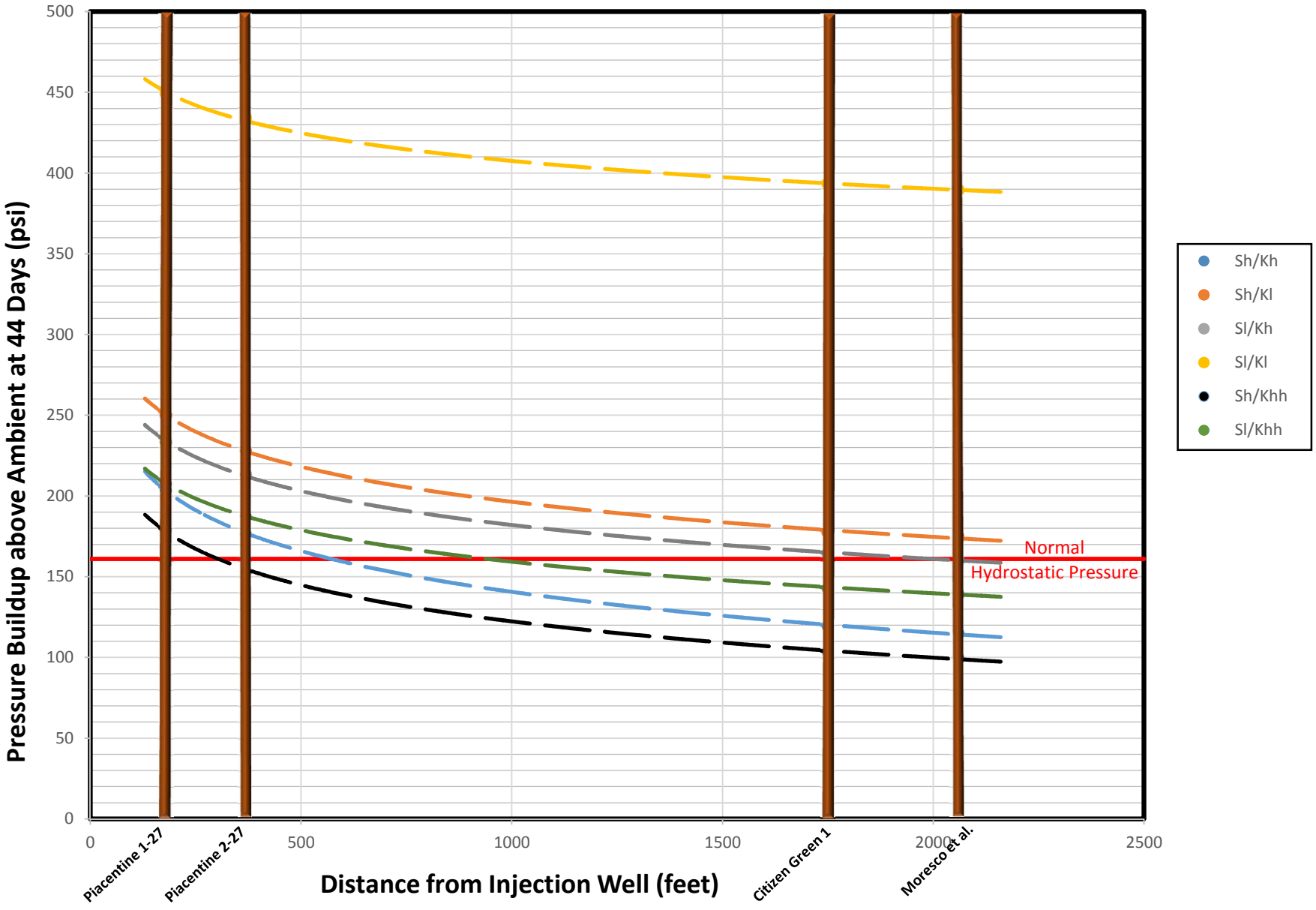
2 - This is the estimated base of fresh water. The Notice of Intention to Abandon Well from DOG on June 24, 1961 indicates that no fresh water was logged.

3 - This is the estimated base of fresh water. The Notice of Intention to Abandon Well dated August 15, 1962 and the Report on Proposed Operations dated September 17, 1962 (DOG), indicate base of fres water sands is 800 feet.

4 - The mud weight refers to the mud used for plugging operations, not drilling operations.

5 - Schlumberger log indicates a mud density of 78. History of Oil or Gas Well Records (DOG) indicate a mud weight of 76-78 at 5000 ft.

FIGURE C-1: PRESSURE BUILDUP vs. DISTANCE FROM INJECTION WELL



LESA 9.6.1, © 1992-2013 Digital Formation, Inc.

File: Piacentine 2-27.lbs Well Name: PIACENTINE 2-27

Plot: L-Full Composite Log - Clean Formation with Lithology-High Porosity

Gross Interval: 550 to 4983 by 0.25 F

Ranges: Zones: Domengine, Capay Shale, Mokelumne, Mokelumne Lower, Base Mokelumne Shale
3790-4654, 4655-4686, 4686-4750, 4750-4816, 4816-4900

Time:	11:41 AM	Date:	Mon, Dec 09, 2013		
Section:	27	Township:	3N	API #:	04-077-20736
Location:	LAT 38.08155572	Range:	5E	UWI:	04-077-20736
Logging date:	24-Mar-2013				
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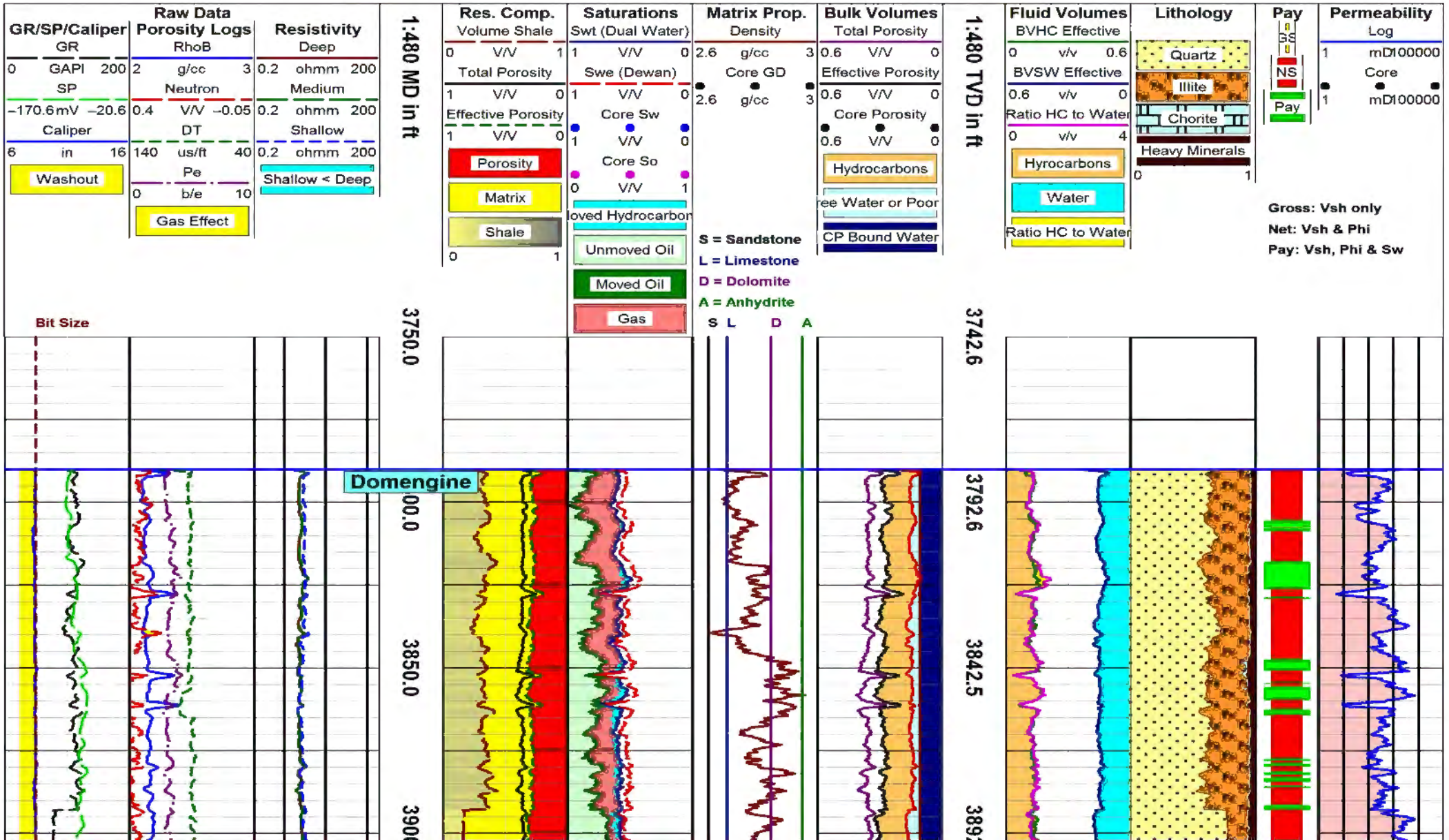
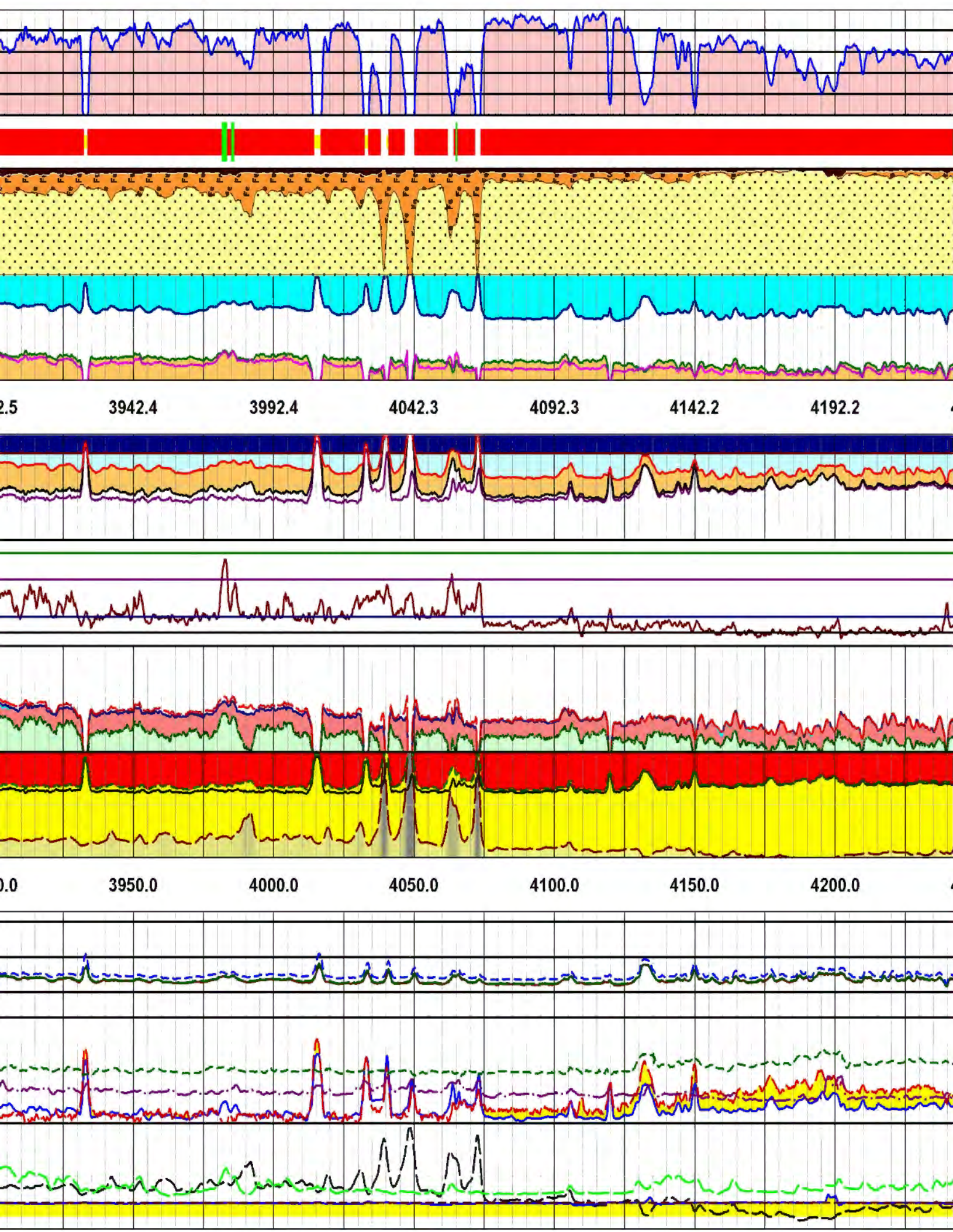
KB:	7.5 ft	Rmf:	2.71 ohmm	Rmf Temp:	123 degF
Total Depth:	4970 ft	Rm @ BHT:	2.06 ohmm	Max Temp:	123 degF

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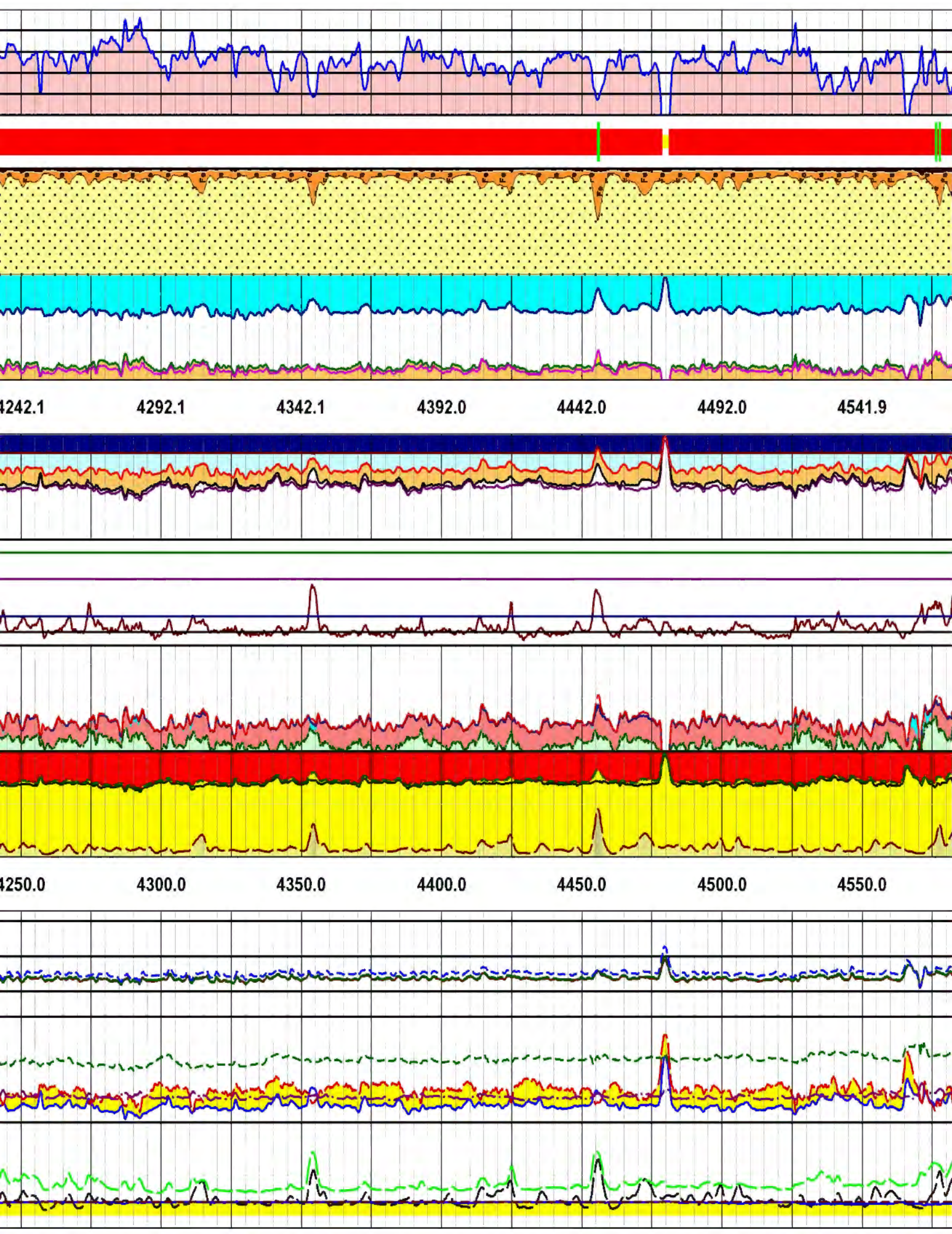
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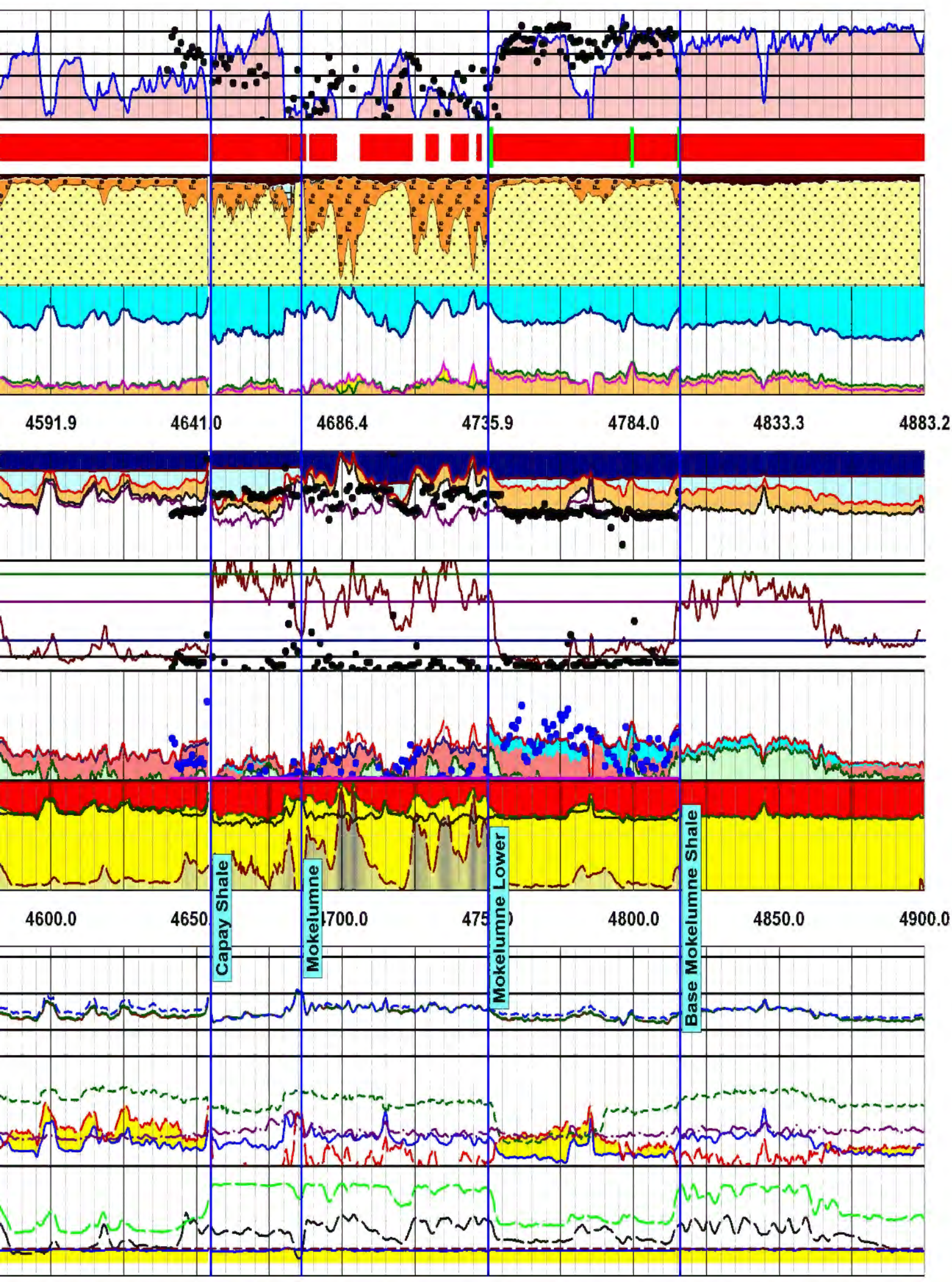
4550.0


4591.9
4641.0
4686.4
4735.9
4784.0
4833.3
4883.2
4600.0
4650
4700.0
475
4800.0
4850.0
4900.0
Capay Shale
Mokelumne
Mokelumne Lower
Base Mokelumne Shale

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

WELL SUMMARY REPORT

API NO. 077-20736

Operator	Well				
PG&E	**Piacentine #2-27**				
Field	County	Sec.	T.	R.	B.&M.
King Island Gas	**San Joaquin**	**27**	**3N**	**5E**	**M.D..**

Location (Give surface location from property or section corner, street center line)
X= 1734574, Y= 577271

Elevation of ground above sea level
-6'

California Coordinates (if known): **Lat: 38.08155572 Long: 121.422162329**

Was the well directionally drilled? ☐ Yes ☒ No If yes, show coordinates at total depth.

Commenced drilling (date)
3/11/13

Completed drilling (date)
3/29/13

Commenced production/injection (date)

Total depth: (1st hole) **4,970' MD** (2nd) (3rd)

Present effective depth **4,970'**

Production mode: ☒ Flowing ☐ Pumping ☐ Gas lift

Junk
none

Name of production/injection zone(s)

Depth measurements taken from top of: ☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing

Which is **12'** feet above ground

GEOLOGICAL MARKERS	DEPTH

Formation and age at total depth
Mokelumne

Base of fresh water
150'

	Clean Oil (bbl per day)	API Gravity (clean oil)	Percent Water (including emulsion)	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production						
Production After 30 days						

CASING AND CEMENTING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New (N) or Used (U)	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)	Top(s) of Cement in Annulus
9-5/8"	Surface	614'	36.0#	K-55, LT&C	**N**	12-1/4	280 sx	Shoe	Surface
5-1/2"	Production	4,969'	15.5#	K-55 SMLS, LT&C	N	8-1/2"	1180 sx	Shoe	Surface

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforations, and method.)

Logs/surveys run? ☒ Yes ☐ No If yes, list type(s) and depth(s).
Mudlog 4,200'-4,970'; DIL/ Sonic/ GR/ Neutron/ Density/ Caliper log from 4,960'-613'; CS natural gamma from 4,878'- 613'; XRMI from 4960'-3800'; MRIL from 4957'-3800'; RDT-A log at 4970'; Side Wall Core from 4809'-4640'; RCBL NL/GR from 4868'-surface.

In compliance with Sec. 3215, Division 3, of the *Public Resources Code*, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name	Title	
PG&E	**Petroleum Engineer**	
Address	City/State	Zip Code
375 North Wiget Ln., #250 Walnut Creek, CA 94598	**Walnut Creek, CA**	**94598**
Telephone Number	Signature	Date
925-974-4151		**5/21/13**

OG100 (1/98/GSR/1M)
Printed on recycled paper.

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Operator PG&E Field King Island Gas County San Joaquin
Well Piacentine 2-27 Sec. 27 T. 3N R. 5E M.D. B.&M.
A.P.I. No. 04-077-20736 Name Irani Engineering (Person submitting report) Title Petroleum Engineer (President, Secretary, or Agent)
Date 4/26/13 (Month, day, year)
Signature
Address 375 North Wiget Ln., #250 Walnut Creek, CA 94598 Telephone Number (925) 974-4151

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment, with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

Date
2013

3/10 Rigged up Paul Graham Drilling #4. Raised and secured derrick. Made up swivel and Kelly hose. Took on water. Welded on conductor. Unloaded 9 5/8" casing. Built spud mud. Changed out pump liners and heads from 5 1/2" to 6" (Pump #1 and pump #2).

3/11 Serviced rig. Changed out pump liners and heads from 5 1/2" to 6" (pump #1 and pump #2). Picked up and made up BHA. Drilled surface hole from 40' to 200', average ROP 64'/hr. 6:00 am Depth 200'. Drilled surface hole from 200' to 255'. Average ROP 27.5'/hr. Serviced rig. Drilled surface hole from 255' to 610'. Average ROP 47'/hr. Drilled surface hole from 610' to 617' TD. Average ROP 14'/hr. Circulated hole clean. Serviced rig. Wiped hole to bit, 5k spot drag. Circulated and wiped hole to conductor, free of drag. Circulated and POOH to run 9 5/8" casing. Laid down BHA, held safety meeting with crews and casing crews. Rigged up casing crews.
Ran 16 joints of 9 5/8" J-55 STC 36# casing to 614'. Shoe set at 614' with insert float set at 577'. Rigged down casing tongs, rig up cementers.

3/12 Circulated and conditioned mud, held safety meeting with crews. Cemented casing as follows: pumped 2 bbl of water to fill lines, pressure tested to 2000 psi, pumped 10 bbl of water ahead of 37 bbl, 120 sacks, 208 cubic feet of lead cement mixed at 13.10 of ppg. Followed with 25 bbl, 100 sacks, 143 cubic feet mixed at 14.5 ppg of tail cement. Dropped plug and displaced with 44.5 bbl of water. Bumped plug, had full returns throughout job with 15 bbl of cement to surface. Pumped 60 sacks top job with tail cement mixed at 14.5 ppg. Waited on cement. Tore out rig floor. Cut off conductor. Cut and dressed 9 5/8" casing. Landed and welded 11" x 3M well head. Landed and welded up 11" x 3M well head. Held safety meeting with crews, serviced rig (tested well head to 500 psi, good test). Landed mud cross. Nippled up all BOPE. Held safety meeting, picked up and landed Hydril (bag). Held orientation for PG&E with new crew, Mike Tietze J/J&A, Mark J/J&A, Patrick the Biologist. Held safety meeting, nippled up Hydrill. Held safety meeting, function tested BOPE. Hammered up lines, function tested BOP.

3/13 Serviced rig, HSM (held safety meeting), pretested blind rams. HSM (held safety meeting), picked up and made up BHA. HSM, Run in hole to 500'. HSM, Pretested pipe rams and Hydril. Function tested all surface equipment (BOPE) for DOG rep Gary. Tests passed. RIH to 577', tagged insert. Drilled out shoe track (plug, insert, and shoe). Wipers on 4-6 hour intervals. Held safety meeting, serviced rig. Drilled out shoe. Circulated and conditioned mud, changed over spud mud to Cypan mud. Circulated and leveled rig. Drilled 8 1/2" hole from 617' to 1004', average ROP 96'/hr. Circulated for wiper, rigged up wire line for survey. Held safety meeting, rigged up survey tool. Ran survey at 1004'. Serviced rig. Wiped hole to shoe, 10K hole drag. Drilled 8 1/2" hole from 1004' to 1330', average ROP 65'/hr.

3/14 Serviced rig, circulated for wiper. Wiped hole to shoe (free of drag). Drilled from 1330' to 1900'. Average ROP 126'/hr. Drilled from 1900' to 2015', average ROP 115'/hr. Wipers on 6 hour intervals. Circulated and conditioned mud, surveyed at 2015'. RCR = 350 psi at 60 stks. Pump #1 and #2. Wiped hole to shoe, 10K hole drag. HSM, serviced rig. Drilled 8 1/2" hole from 2015' to 2518', average ROP 111'/ hr. HSM, circulated and fix dog nut (cable clamp on drilling line). Serviced rig. Slipped 100' drilling line. Wiped hole to 1847', 10K spot drag. Drilled 8 1/2" hole from 2518' to 2925', average ROP 81'/hr.

3/15 Held safety meeting, serviced rig. Drilled 8 1/2" hole from 2925' to 3021', average ROP 96'/hr. Circulated, surveyed at 3021'. Wiped hole from 3021' to 2350', 10-20K spot drag. Drilled 8 1/2" hole from 3021' to 3225', average ROP 81'/hr. Drilled 8 1/2" hole from 3225' to 3333', average ROP 43'/hr. Wipers on 6 hour intervals. Circulated, HSM, serviced rig.

Fixed Dog Nut, cable clamp on drilling line. Pulled out of hole to shoe. Changed out drilling line. Fixed standpipe valve. HSM, adjusted brakes. Serviced rig. Run in hole. Drilled 8 1/2" hole from 3530' to 3594', average ROP 44'/hr.

3/16 HSM, serviced rig. Drilled 8 1/2" hole from 3530' to 3594', average ROP 44'/hr. Circulated and wiped hole from 3594' to 2992', 10-20K hole drag with little swabbing. Drilled 8 1/2" hole from 3594' to 3800', average ROP 58'/hr. Drilled 8 1/2" hole from 3837' to 3913', average ROP 61'/hr. Wipers on 6 hour intervals. Circulated, HSM, serviced rig. Surveyed at 3913'. Wiped hole to 3204', 20K hole drag with some swabbing. Mud weight at 9.8 ppg. Drilled 8 1/2" hole from 3913' to 4165', average ROP 45'/hr. Held safety meeting. Circulated and serviced rig. Wiped hole to 4165'. Increased mud weight to 10.2 ppg for hole drag (free with no swabbing). Drilled 8 1/2" hole from 4165' to 4417', average ROP 42'/hr.

3/17 Circulated and wiped hole to 3746', free. HSM, Service rig. Drilled 8 1/2" hole from 4417' to 4640', average ROP 55'/hr. Coring Point. Drilled to 4641'. Circulated, HSM. Surveyed, Serviced rig. POOH, coring point. HSM, serviced rig. Laid Down BHA. Made up BHA and core barrel. Made up BHA. RIH with heavy weight drill pipe (HWDP). Placed insert valve in upper kelly. Circulated, RIH to 1831'. Reamed from 1831' to 2075'. RIH to 3200'. Filled pipe. Circulated and conditioned mud. Cored from 4641' to 4650'.

3/18 HSM, serviced rig. Cored from 4650' to 4666'. Dropped 1 1/4" ball to close core barrel, circulated. POOH, slowed to 3-4 minutes per stand. POOH. HSM, serviced rig. POOH. Unloaded and loaded core barrel. Made up bit, made up BHA. Unloaded jars, RIH, made up Jars. Loaded 1" ball in upper Kelly. Replaced Jerk Line on tongs (Code 8). HSM, serviced rig. Run in Hole (RIH), measured pipe on the way in. 4664' pipe and tools, 2' Kelly, 4666' hole depth correction. Circulated and conditioned mud. Cored from 4666' to 4669'.

3/19 HSM, serviced rig. Cored from 4669' to 4685'. Cored from 4685' to 4687'. POOH, laid down core barrel. Received 18.5' out of 21' cored. HSM, serviced rig. Loaded core barrel. Made up core tools. RIH, filled pipe at 2500'. Run in hole to 4687'. Circulated and conditioned mud. Cored from 4687' to 4701', 14' cored.

3/20 HSM, serviced rig. Laid down pup joints and single drill pipe. POOH 3 minutes a stand 4701' to 1500'. 1500' to 500' at 4 minutes a stand, 500' to surface at 10 minutes a stand. Laid down core. Cored 14' and recovered 13.85'. Laid down core, loaded core barrel. RIH, loaded 1 1/4" ball in upper kelly. HSM, serviced rig. RIH to 4701'. Circulated and conditioned mud. Cored from 4701' to 4731'. Cored 30'. Circulated and conditioned mud.

3/21 POOH to 580'. Held safety meeting, serviced rig. POOH, break bit. HSM, laid down core barrel. Cored 30' from 4701' to 4731' and recovered 28.2'. Serviced rig, held safety meeting. Loaded core barrel, made up bit. RIH with BHA. HSM with crews. Broke kelly, loaded 1 1/4" Ball in upper Kelly. RIH, (held blow out drill). HSM, serviced rig. Circulated and conditioned mud. Cored from 4731' to 4761'. Circulated and conditioned mud. POOH.

3/22 POOH. Break bit, HSM, serviced rig. Laid down core barrel. Loaded core barrel, make up bit. RIH with BHA, loaded 1 1/4" ball in upper Kelly. Made up kelly, RIH. Cored 30' from 4731' to 4761'. Recovered 32' of Core. 2 feet from 4729' to 4731'. 30' from 4731' to 4761'. RIH, Filled pipe at 2500' (HSM). Circulated and conditioned mud. Cored from 4761' to 4791', cored 30' and recovered 28.85'. Circulated and conditioned mud. POOH with core barrel. Serviced rig, HSM. POOH, laid down core barrel. Repaired rig (replaced chain on Hydromatic). Made up core barrel. RIH with core barrel, loaded 1 1/4" ball in upper Kelly. Run In Hole.

3/23 Continued to RIH. Circulated and conditioned mud. Cored from 4791' to 4816', 25' cored. POOH. HSM, serviced rig. POOH. Laid down core barrel and tools. TD with Coring Assembly. Cored from 4791' to 4816', 25' Cored. Recovered 27', 2' from previous Core and 25' from this Coring run. Measured new BHA. HSM, serviced rig. Picked up and made up new BHA. RIH to 4815'. Circulate and conditioned mud. Drilled 8 1/2" Hole from 4816' to 4970' TD.

3/24 Continued to drill 8 1/2" Hole from 4816' to 4970' TD. Circulated and conditioned mud. Wiped hole to shoe, free. HSM, serviced rig. Adjusted brakes. RIH. HSM, Serviced rig. Run In Hole. Circulated and conditioned mud. Wiped hole to 3690', free. Circulated and conditioned mud. Wiped hole to 4000', free. Had to wait for Halliburton. Circulated and conditioned mud. HSM, serviced rig, circulated and conditioned mud. Halliburton on site at 20:30. Pulled out of hole for logs. HSM with loggers and crews.
Ran Quad Combo Pack, DIL/ Sonic / GR / Neutron / Density / Caliper Log from 4960' to 613'.
Ran compensated spectral natural gamma logs from 4878'-613'.

3/25 HSM with loggers and with crews.
Ran 2nd set of logs XRMI from 4960' to 3800'. Hole in good shape, no over pulls and both sets of logs went to bottom. Laid down logs, HSM. Run logs (XRMI). HSM, serviced rig .
Ran MRIL log from 4957' to 3800'. Laid down logs. RIH, filled pipe at 2500'. HSM, Serviced rig. Run In Hole. Circulated and conditioned mud, (circulated hole clean). Pulled out of hole (free). Rig up Halliburton for Logs, HSM.
Ran RDT-A log at 4970'.

3/26 HSM, serviced rig.

Ran Side Wall Core logs from 4809'-4640'. HSM, serviced rig. Laid down loggers. RIH to shoe, 600'. Slipped and cut 60' of drilling line. RIH. HSM, serviced rig. RIH to 4970'. Circulated and conditioned mud, rigged up lay down equipment. Wiped hole to 3648', free (wait on cementers). Circulated and conditioned mud. Laid down 4 1/2" drill pipe.

3/27 HSM, Serviced rig. Laid down 4 1/2" drill pipe. HSM with all crews. Rigged up casing crew,
Ran 5 1/2" 15.5 #, J-55 LTC 8 round casing to 4969'. Shoe set at 4967' with Diff. Collar set at 4723'. HSM, serviced rig. Rigged down casing crew. Made up circulating swedge. Circulated hole clean. 2 hours waiting on Halliburton, only 2 pump trucks on location. HSM with all crews. Cemented casing as follows: Mixed and pumped 20 bbl of mud flush ahead of 20 bbl of 11 ppg Tuned Spacer 111 followed by 870 sacks (1044 cubic feet) at 14.5# 186 bbl of lead cement. Followed with 310 sacks (356.5 cubic feet) at 15.8 ppg ramped up to 16.2 ppg, 64 bbl. Flushed and cleaned lines, dropped top plug and displaced with 112 bbl of H2O, bumped plug at 2000 psi over circulating pressure. Had full returns throughout cement job with 10 bbl of cement to surface. CIP @ 20:13. HSM, Rigged down Halliburton. Landed casing slips with 30K over string weight.

3/28 Nippled down all BOPE. Cut off and dressed casing to fit tubing head. Landed and Nippled up Tubing head. Tested to 3000 psi (Good). Cleaned mud pits. HSM. Release rig at 14:00 hours. Tear out rig for road move. Rig idle, wait on daylight to finish tearing out rig. Loaded out rig, took 8 loads to Morais location. The other loads to yard. Put fence around cellar and plate on rat hold. Wait on daylight to finish bringing in rig.

5/6 Conducted safety meeting, filled out JSA. Rigged up Halliburton to run Radial cement bond NL/GR log. Ran in the hole to 4868.0' and tagged (PB 4920.0').
Ran RCBL, NL/GR logs from 4868.0' to surface. Top of good cement at 612.0'. Poor bonding from 612.0' to surface. Rigged out wireline.

PG&E

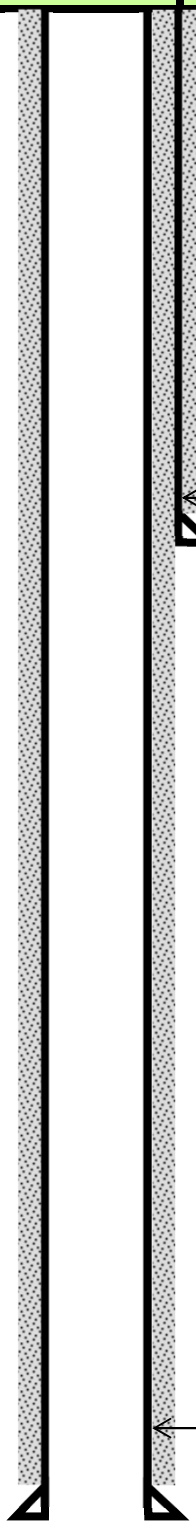
Piacentine 2-27 (API No. 077-20736) Competion Schematic

San Joaquin, California

Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -4.5' ground, +7.5' KB. All the measurements are from KB which is 12' above ground.

Installation		Depth & Description (after Planned Completion)	OD	ID
		16" Conductor at 60'		
		9-5/8", 36# J-55 STC Casing at 614' (12-1/4" hole) (Cemented to Surface with 280 Sacks)	9-5/8"	8.921"
		5-1/2", 15.5#, J-55, LT&C Casing set at 4969' (Cemented to Surface with 1180 Sacks)	5-1/2"	4.950"
		TD=~4920' TD=4970'		

Prepared by Irani Engineering 1/2/2014

Geolog

FORMATION EVALUATION LOG

Scale: 2" = 100'

COMPANY:	**PG&E**
WELL:	**"Piacentine" 2-27**
FIELD:	**King Island Gas**
COUNTY:	**San Joaquin, CA**
Location:	Sec. 27, T3N-R5E, MDB&M
Coordinates:	Lat: 38.08155572
	Long: 121.422162329
API No.:	04-077-20736
Spud Date:	3/11/13
Total Depth:	3/24/13
Elevation: K.B.	7.52' NGVD29
G.L.	-4.48' NGVD29
Company Geologist:	Frank B. Cressy JR.
Company Engineer:	Irani Engineering
Company Pusher:	Ted Coffey
Directional Engineer:	
Mud Company:	Halliburton
Mud Engineer:	William Barrett
Drilling Contractor:	Paul Graham Drilling
Rig Pusher:	C. Johnson, C. Parker
Rig No.:	4
Geolog Unit No.:	101
Logging Geologists:	Mark Fowler
	Eric Nigh

LOG INTERVAL

DATES:	3/16/13	TO	3/25/13
		TO	
DEPTHS:	4200'	TO	4970'
		TO	

TOTAL DEPTH

MEASURED:	4970'
TRUE VERTICAL:	4970'

MUD TYPES

Gel/Water	TO	617'
Cypan	TO	4970'
	TO	

HOLE SIZE

12-1/4"	TO	617'
8-1/2"	TO	4970'
	TO	

MUD PUMPS

PUMP #1: Gardner-Denver PZ-9 (6" x 9")

PUMP #2: Gardner-Denver PZ-9 (6" x 9")

CASING DATA

9-5/8"	AT	614'
	AT	
	AT	

LEGEND

BG - Background Gas
CB - Core Bit
CG - Connection Gas
CK - Filter Cake
CKF - Check for Flow
CL - Salinity, ppm Cl
CR - Circulate Returns
DB - Diamond Bit
DC - Depth Correction
DCB - Diamond Core Bit
DF - Derrick Floor
DG - Drilling Gas
DS - Directional Survey
DST - Drill Stem Test
EL - Electric Log
E.M.A. - Equivalent Methane in Air, 1% = 50 Units
F - Filtrate, API cc's
F/T - Flowline Temperature
GCM - Gas Cut Mud
GCW - Gas Cut Water
G & OCM - Gas and Oil Cut Mud
GL - Ground Level
KB - Kelly Bushing
LAT - Logged After Trip
NB - New Bit
NCB - New Core Bit
NR - No Returns
PDC - Polycrystalline Diamond Compact Bit
LC - Lost Circulation
PPM - Parts Per Million
PR - Poor Returns
PP - Pump Pressure
PV - Plastic Viscosity
RM - Mud Resistivity, Ohm-Meter
RMC - Mud Cake Resitivity, Ohm-Meter
RMF - Mid-Filtrate Resistivity, Ohm-Meter
RPM - Revolutions Per Minute
RRB - Rerun Bit
RT - Rotary Table
SD - Sand %
SO - Show of Oil
SOL - Solids %
SPM - Strokes Per Minute
STG - Short Trip Gas
SWG - Swab Gas
SVG - Survey Gas
S/T - Suction Temperature
T.D. - Total Depth
TCL - Trip Chlorides
TG - Trip Gas
TVD - True Vertical Depth
V - Viscosity, API seconds
W - Weight of Mud, ppg/pcf
WOB - Weight on Bit

CEMENT
LIMESTONE
DOLOMITE
GYPSUM
ANHYDRITE
COAL & LIGNITE
CLAY
SHALE
SILTSTONE
SANDY SILTSTONE
FINE SAND
MEDIUM SAND
COARSE SAND
CONGLOMERATE
SANDSTONE
KAOLINITE
TUFF
COQUINA
GLAUCONITE
DIATOMITE
PORCELANITE
CHERT
VOLCANIC
IGNEOUS
METAMORPHIC

DRILL RATE
ft/hr
Backup Scale - x10
400 300 200 100
Started Logging at 12:00 PM on 3/16/13
NB #2 SMITH XR-T

DEPTH

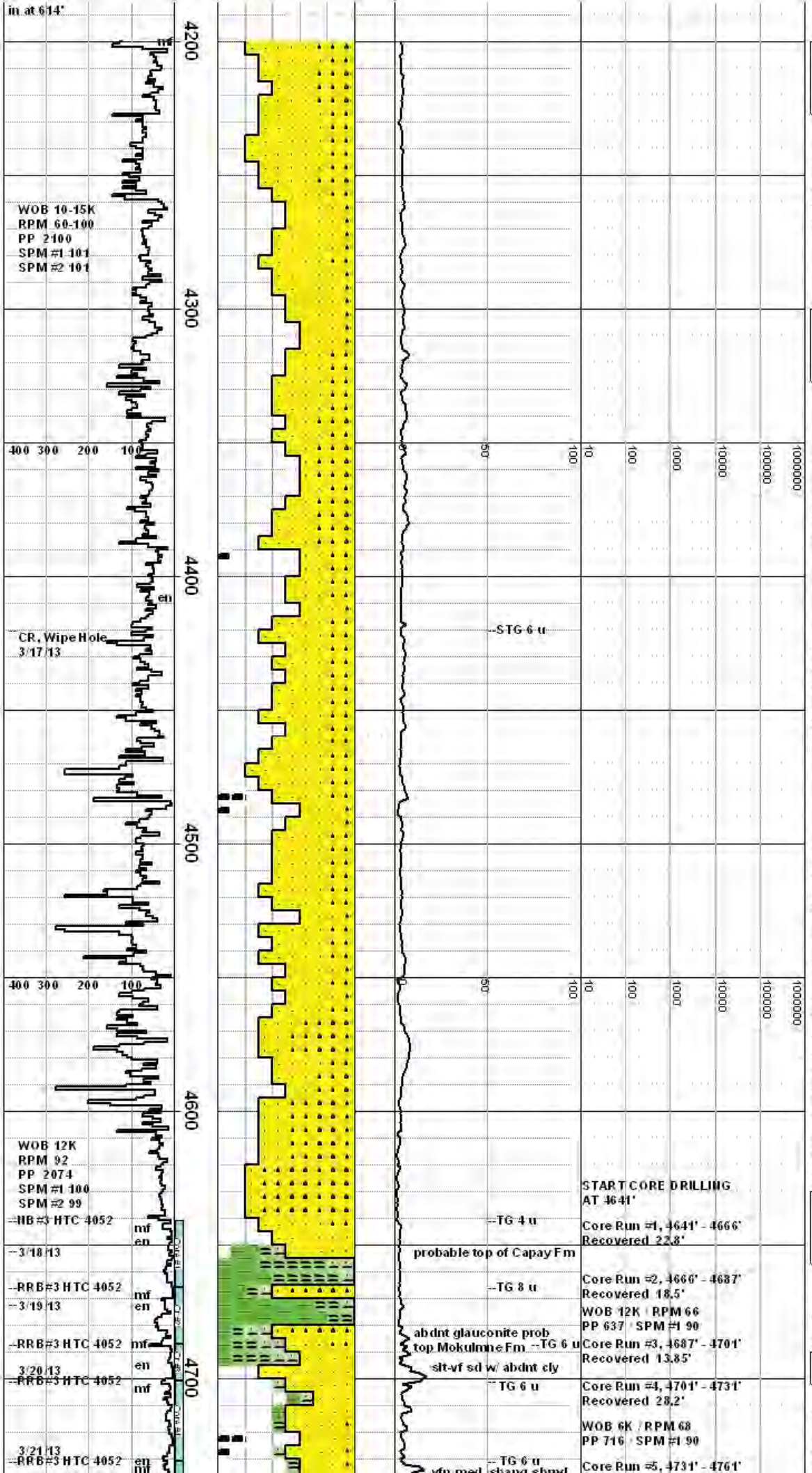
CUTTINGS LITHOLOGY
%
< 0 100 >

OIL
TRACE
FAIR
GOOD

TOTAL GAS
Ditch
Cuttings
units
< 1000 10000 >
< 100 1000 >
< 0 100 >

CHROMATOGRAPH
C1 C2 C3 C4 C5
ppm
10 100 1K 10K 100K 1M

LITHOLOGY DESCRIPTIONS & REMARKS



Ran16 joints of 9 5/8" 36# J-55 casing, set at 614'. Drill ahead with 8-1/2" bit.

Sand: cr-mlky, mnr maffics, predom unconsol, fn-crs, occ pbl, subang-rnd, pr srt, mod sphere, mnr slky, sol, clys

W 10.2 V 39 PV 18 YP 11
Gels 4/6/9 pH 6.8 F 3.8 Ck1/0
Sol 8.9% Sd 1.0% Cl 500

Sand: cr-mlky, occ maffics, unconsol, fn-crs, occ pbl, subang-rnd, pr srt, rare sblky, sltstn, mnr slky, sol, clys, tr, kaolin, pyrite, lignite

Sand: wht, gy, clr, uncons, f-c gr, pred m gr, sbang-sbrnd, fr srtd, vitr-semitransl, w/ mod abdnt m gy cly, fair wtr solbl, also varbl dk brn-blk lign, blky, smth, tr mica, tr lith frag acc

Sand: wht, var gy, clr, uncons, f-c gr, pred m gr, sbang-sbrnd, fr srtd, vitr-semitransl, w/ mod abdnt m gy cly, fair wtr solbl, also loc abdnt but varbl dk brn-blk lign, blky, smth, tr mica, tr lith frag acc

Sand: wht, var gy, clr, uncons, f-c gr, pred c gr, sbang-sbrnd, fr srtd, vitr-semitransl, w/ mod abdnt m gy cly, fair wtr solbl, also mnr dk blk lign, blky, smth, tr mica, tr lith frag acc

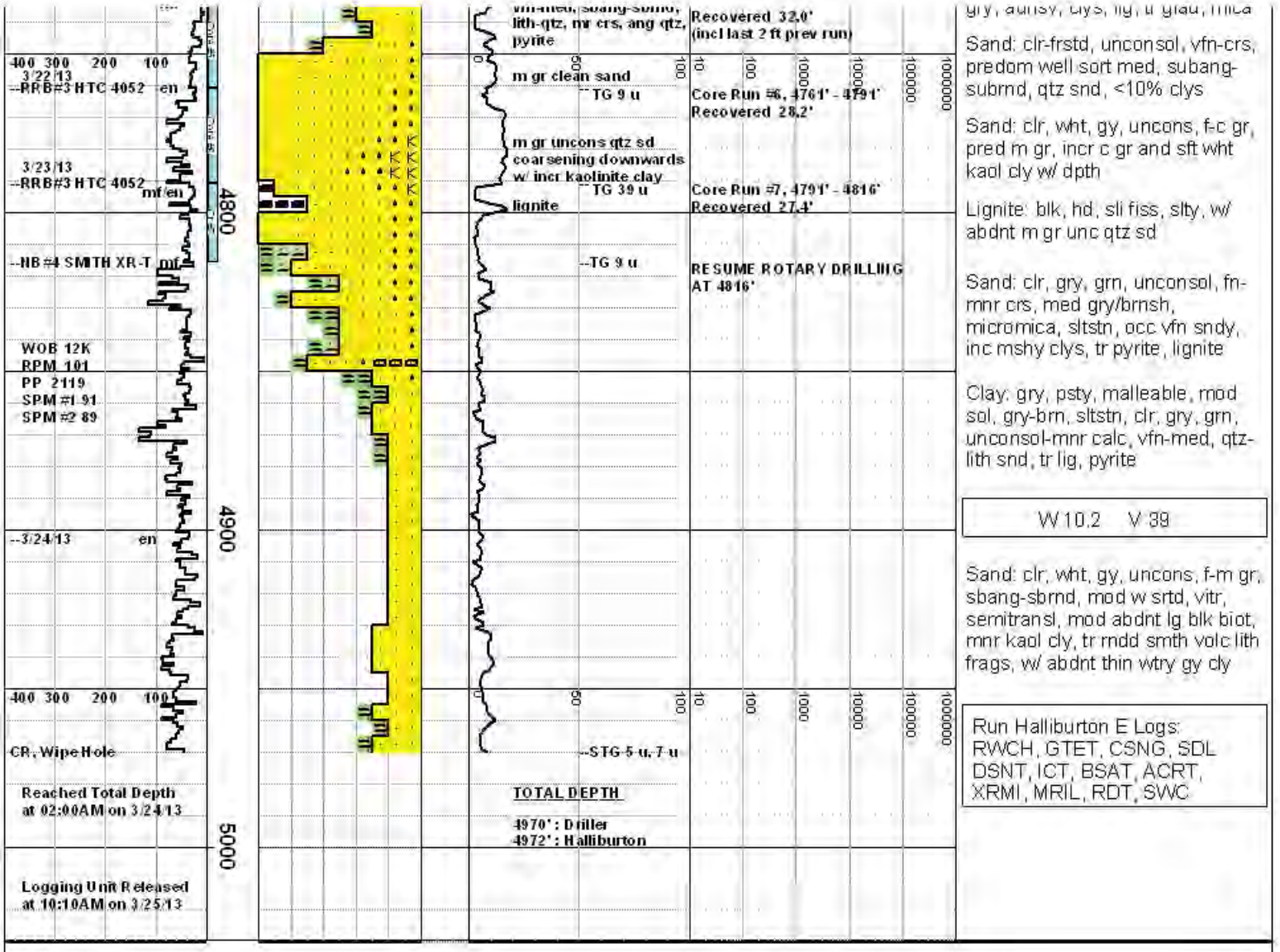
Sand: wht, var gy,clr, unconsol, m-predom crs, subang, p srt, msv, mnr lign, tr lith acc, drk brn sltstn (>3%)

W 10.2 V 39 PV 18 YP 11
Gels 4/7/10 pH 8.0 F 3.6 Ck 1
Sol 10% Sd 1.0% Cl 500

Siltstone: lt gy, sft, v p cons, f-m gr, occ sdy, p srtd, massive, subrnd ctgs, qtz w/ mnr vf dk lith frag incl in abdnt gy cly , w hydrtd

W 10.2 V 38

Sand: gry, brn, grn, unconsol, vfn-crs, m srt, lith, clr-mlky, vf-fn, w srt -occ fn-crs pr srt qtz, lt gry-brn, occ calc, stab-sblky sltstn, gry, adhsv clys, lig, tr glau, mica



gry, admsy, clys, lig, fl glau, mica

Sand: clr-frstd, unconsol, vfn-crs, predom well sort med, subang-subrnd, qtz snd, <10% clys

Sand: clr, wht, gy, uncons, f-c gr, pred m gr, incr c gr and sft wht kaol cly w/ dpth

Lignite: blk, hd, sli fiss, slty, w/ abdnt m gr unc qtz sd

Sand: clr, gry, grn, unconsol, fn-mnr crs, med gry/brnsh, micromica, sltstn, occ vfn sndy, inc mshy clys, tr pyrite, lignite

Clay: gry, psty, malleable, mod sol, gry-brn, sltstn, clr, gry, grn, unconsol-mnr calc, vfn-med, qtz-lith snd, tr lig, pyrite

W 10.2 V 39

Sand: clr, wht, gy, uncons, f-m gr, sbang-sbrnd, mod w srtd, vitr, semitransl, mod abdnt lg blk biot, mnr kaol cly, tr rndd smth volc lith frags, w/ abdnt thin wtry gy cly

Run Halliburton E Logs:
RWCH, GTET, CSNG, SDL DSNT, ICT, BSAT, ACRT, XRMI, MRIL, RDT, SWC

Comments:

PG&E | "Placentine" 2-27 | King Island Gas | Sec. 27, T3N-R5E; MDB&M

Geolog

FORMATION EVALUATION LOG

Scale: 2" = 100'

Geolog

FORMATION EVALUATION LOG

Scale: 2" = 100'

COMPANY:	PG&E
WELL:	"Piacentine" 2-27
FIELD:	King Island Gas
COUNTY:	San Joaquin, CA
Location:	Sec. 27, T3N-R5E, MDB&M
Coordinates:	Lat: 38.08155572
	Long: 121.422162329
API No.:	04-077-20736
Spud Date:	3/11/13
Total Depth:	3/24/13
Elevation: K.B.	7.52' NGVD29
G.L.	-4.48' NGVD29
Company Geologist:	Frank B. Cressy JR.
Company Engineer:	Irani Engineering
Company Pusher:	Ted Coffey
Directional Engineer:	
Mud Company:	Halliburton
Mud Engineer:	William Barrett
Drilling Contractor:	Paul Graham Drilling
Rig Pusher:	C. Johnson, C. Parker
Rig No.:	4
Geolog Unit No.:	101
Logging Geologists:	Mark Fowler
	Eric Nigh

LOG INTERVAL

DATES:	3/16/13	TO	3/25/13
		TO	
DEPTHS:	4200'	TO	4970'
		TO	

TOTAL DEPTH

MEASURED:	4970'
TRUE VERTICAL:	4970'

MUD TYPES

Gel/Water	TO	617'
Cypan	TO	4970'
	TO	

HOLE SIZE

12-1/4"	TO	617'
8-1/2"	TO	4970'
	TO	

MUD PUMPS

PUMP #1: Gardner-Denver PZ-9 (6" x 9")

PUMP #2: Gardner-Denver PZ-9 (6" x 9")

CASING DATA

9-5/8"	AT	614'
	AT	
	AT	

LEGEND

BG - Background Gas
CB - Core Bit
CG - Connection Gas
CK - Filter Cake
CKF - Check for Flow
CL - Salinity, ppm Cl
CR - Circulate Returns
DB - Diamond Bit
DC - Depth Correction
DCB - Diamond Core Bit
DF - Derrick Floor
DG - Drilling Gas
DS - Directional Survey
DST - Drill Stem Test
EL - Electric Log
E.M.A. - Equivalent Methane in Air, 1% = 50 Units
F - Filtrate, API cc's
F/T - Flowline Temperature
GCM - Gas Cut Mud
GCW - Gas Cut Water
G & OCM - Gas and Oil Cut Mud
GL - Ground Level
KB - Kelly Bushing
LAT - Logged After Trip
NB - New Bit
NCB - New Core Bit
NR - No Returns
PDC - Polycrystalline Diamond Compact Bit
LC - Lost Circulation
PPM - Parts Per Million
PR - Poor Returns
PP - Pump Pressure
PV - Plastic Viscosity
RM - Mud Resistivity, Ohm-Meter
RMC - Mud Cake Resitivity, Ohm-Meter
RMF - Mid-Filtrate Resistivity, Ohm-Meter
RPM - Revolutions Per Minute
RRB - Rerun Bit
RT - Rotary Table
SD - Sand %
SO - Show of Oil
SOL - Solids %
SPM - Strokes Per Minute
STG - Short Trip Gas
SWG - Swab Gas
SVG - Survey Gas
S/T - Suction Temperature
T.D. - Total Depth
TCL - Trip Chlorides
TG - Trip Gas
TVD - True Vertical Depth
V - Viscosity, API seconds
W - Weight of Mud, ppg/pcf
WOB - Weight on Bit

CEMENT
LIMESTONE
DOLOMITE
GYPSUM
ANHYDRITE
COAL & LIGNITE
CLAY
SHALE
SILTSTONE
SANDY SILTSTONE
FINE SAND
MEDIUM SAND
COARSE SAND
CONGLOMERATE
SANDSTONE
KAOLINITE
TUFF
COQUINA
GLAUCONITE
DIATOMITE
PORCELANITE
CHERT
VOLCANIC
IGNEOUS
METAMORPHIC

DRILL RATE
ft/hr
Backup Scale - x10
400 300 200 100

DEPTH

CUTTINGS LITHOLOGY
%
< 0 100 >

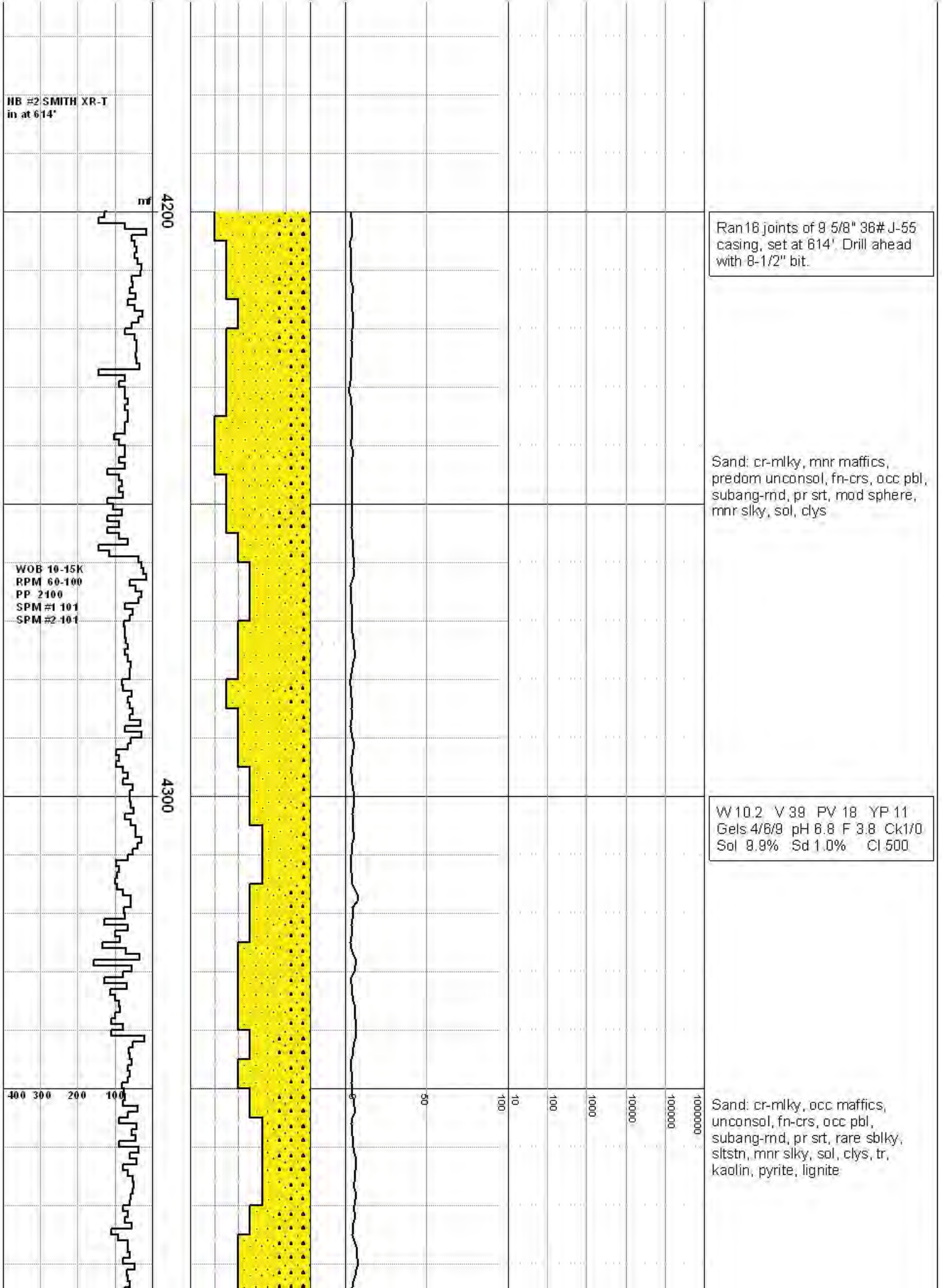
OIL
TRACE FAIR GOOD

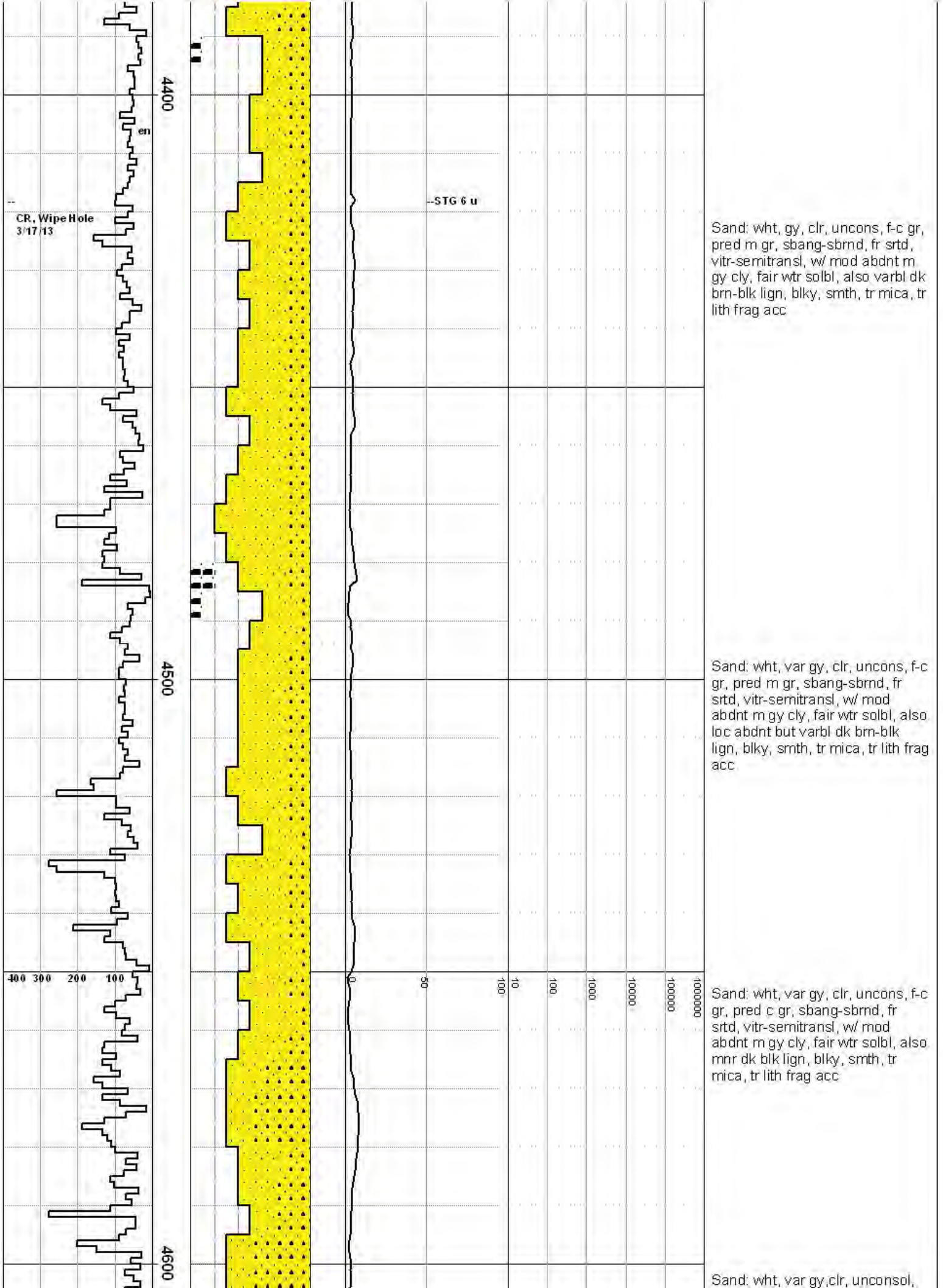
TOTAL GAS
Ditch
Cuttings
units
< 1000 10000 >
< 100 1000 >
< 0 100 >
0 50 100

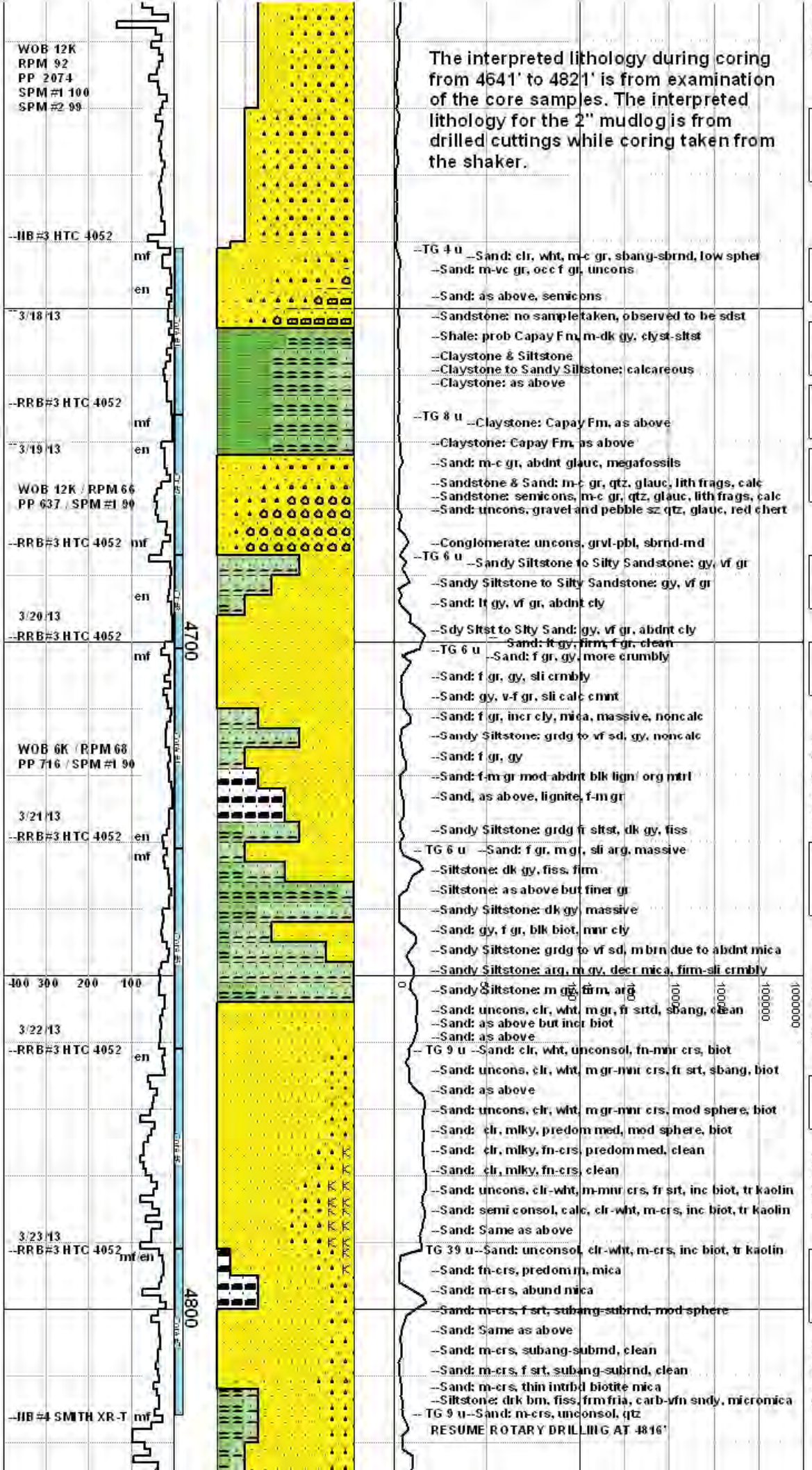
CHROMATOGRAPHY
C1 C2 C3 C4 C5
ppm
10 100 1K 10K 100K 1M
10 100 1000 10000 100000 1000000

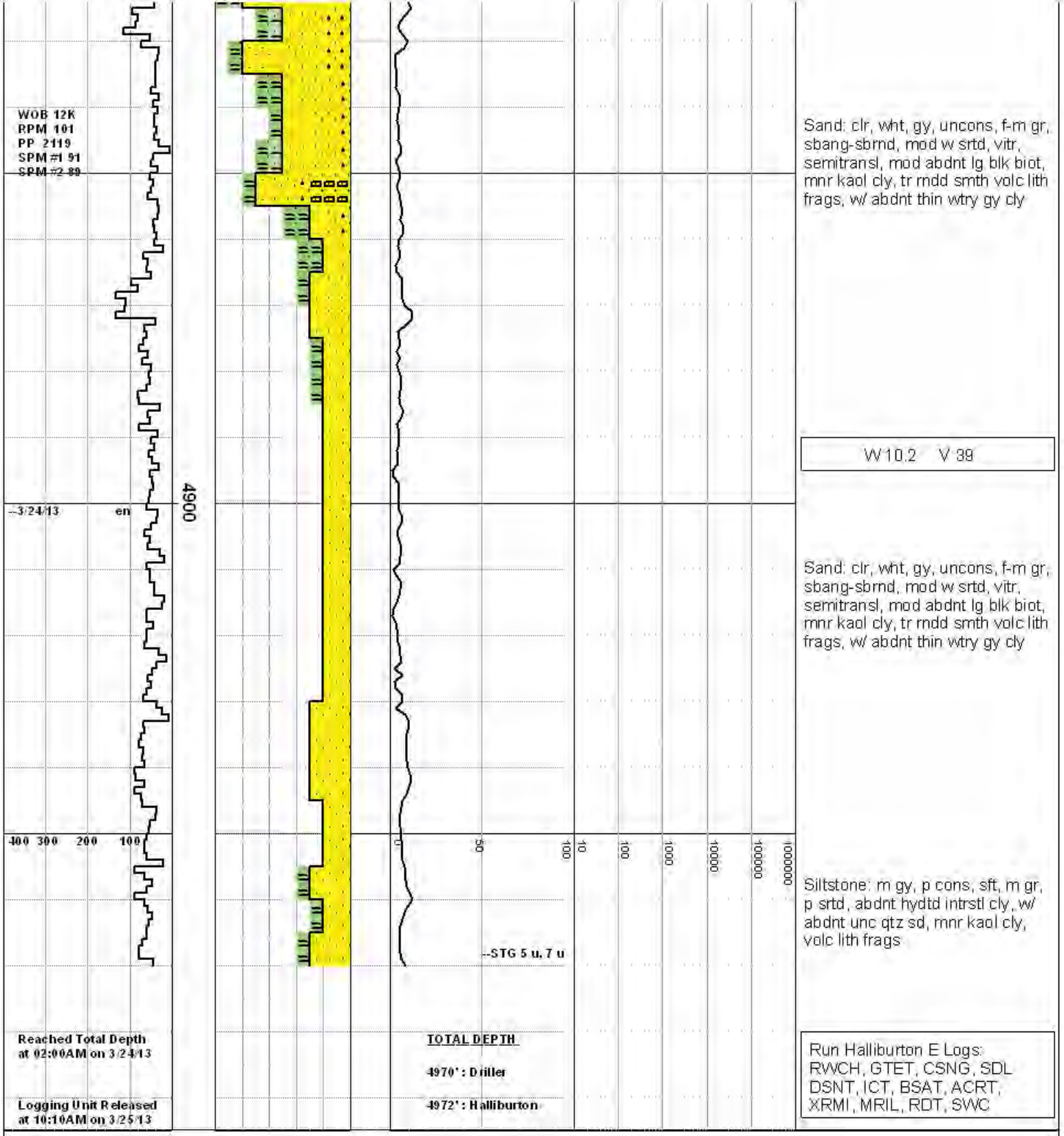
LITHOLOGY DESCRIPTIONS & REMARKS

Started Logging at 12:00 PM on 3/16/13


NB #2 SMITH XR-T
in at 614'
mf
4200
WOB 10-15K
RPM 60-100
PP 2100
SPM #1 101
SPM #2 101
4300
400 300 200 100
0 50 100
10 100 1000 10000 100000 1000000
Ran16 joints of 9 5/8" 36# J-55 casing, set at 614'. Drill ahead with 8-1/2" bit.
Sand: cr-mlky, mnr maffics, predom unconsol, fn-crs, occ pbl, subang-rnd, pr srt, mod sphere, mnr slky, sol, clys
W 10.2 V 39 PV 18 YP 11
Gels 4/6/9 pH 6.8 F 3.8 Ck1/0
Sol 8.9% Sd 1.0% Cl 500
Sand: cr-mlky, occ maffics, unconsol, fn-crs, occ pbl, subang-rnd, pr srt, rare sblky, sltstn, mnr slky, sol, clys, tr, kaolin, pyrite, lignite


4400
4500
4600
en
--
CR, Wipe Hole
3/17/13
--STG 6 u
400 300 200 100
0 50 100
10 100 1000 10000 100000
Sand: wht, gy, clr, uncons, f-c gr, pred m gr, sbang-sbrnd, fr srtd, vitr-semitransl, w/ mod abdnt m gy cly, fair wtr solbl, also varbl dk brn-blk lign, blky, smth, tr mica, tr lith frag acc
Sand: wht, var gy, clr, uncons, f-c gr, pred m gr, sbang-sbrnd, fr srtd, vitr-semitransl, w/ mod abdnt m gy cly, fair wtr solbl, also loc abdnt but varbl dk brn-blk lign, blky, smth, tr mica, tr lith frag acc
Sand: wht, var gy, clr, uncons, f-c gr, pred c gr, sbang-sbrnd, fr srtd, vitr-semitransl, w/ mod abdnt m gy cly, fair wtr solbl, also mnr dk blk lign, blky, smth, tr mica, tr lith frag acc
Sand: wht, var gy,clr, unconsol,


WOB 12K
RPM 92
PP 2074
SPM #1 100
SPM #2 99
--HB #3 HTC 4052
mf
en
3/18/13
--RRB #3 HTC 4052
mf
3/19/13
en
WOB 12K / RPM 66
PP 637 / SPM #1 90
--RRB #3 HTC 4052
mf
en
3/20/13
--RRB #3 HTC 4052
4700
mf
WOB 6K / RPM 68
PP 716 / SPM #1 90
3/21/13
--RRB #3 HTC 4052
en
mf
400 300 200 100
3/22/13
--RRB #3 HTC 4052
en
3/23/13
--RRB #3 HTC 4052
mf en
4800
--HB #4 SMITH XR-T
mf
The interpreted lithology during coring from 4641' to 4821' is from examination of the core samples. The interpreted lithology for the 2" mudlog is from drilled cuttings while coring taken from the shaker.
--TG 4 u
--Sand: clr, wht, m-c gr, sbang-sbrnd, low spher
--Sand: m-vc gr, occ f gr, uncons
--Sand: as above, semicons
--Sandstone: no sample taken, observed to be sdst
--Shale: prob Capay Fm, m-dk gy, clyst-sltst
--Claystone & Siltstone
--Claystone to Sandy Siltstone: calcareous
--Claystone: as above
--TG 8 u
--Claystone: Capay Fm, as above
--Claystone: Capay Fm, as above
--Sand: m-c gr, abdnt glauc, megafossils
--Sandstone & Sand: m-c gr, qtz, glauc, lith frags, calc
--Sandstone: semicons, m-c gr, qtz, glauc, lith frags, calc
--Sand: uncons, gravel and pebble sz qtz, glauc, red chert
--Conglomerate: uncons, grvl-pbl, sbrnd-rnd
--TG 6 u
--Sandy Siltstone to Silty Sandstone: gy, vf gr
--Sandy Siltstone to Silty Sandstone: gy, vf gr
--Sand: lt gy, vf gr, abdnt cly
--Sdy Sltst to Slty Sand: gy, vf gr, abdnt cly
--TG 6 u
--Sand: lt gy, firm, f gr, clean
--Sand: f gr, gy, more crumbly
--Sand: f gr, gy, sli crmbly
--Sand: gy, v-f gr, sli calc cmnt
--Sand: f gr, incr cly, mica, massive, noncalc
--Sandy Siltstone: grdg to vf sd, gy, noncalc
--Sand: f gr, gy
--Sand: f-m gr mod abdnt blk lign/ org mtrl
--Sand, as above, lignite, f-m gr
--Sandy Siltstone: grdg to sltst, dk gy, fiss
-- TG 6 u --Sand: f gr, m gr, sli arg, massive
--Siltstone: dk gy, fiss, firm
--Siltstone: as above but finer gr
--Sandy Siltstone: dk gy, massive
--Sand: gy, f gr, blk biot, mnr cly
--Sandy Siltstone: grdg to vf sd, m brn due to abdnt mica
--Sandy Siltstone: arg, m gy, decr mica, firm-sli crmbly
--Sandy Siltstone: m gy, firm, arg
--Sand: uncons, clr, wht, m gr, fr srtd, sbang, clean
--Sand: as above but incr biot
--Sand: as above
-- TG 9 u --Sand: clr, wht, unconsol, fn-mnr crs, biot
--Sand: uncons, clr, wht, m gr-mnr crs, fr srt, sbang, biot
--Sand: as above
--Sand: uncons, clr, wht, m gr-mnr crs, mod sphere, biot
--Sand: clr, milky, predom med, mod sphere, biot
--Sand: clr, milky, fn-crs, predom med, clean
--Sand: clr, milky, fn-crs, clean
--Sand: uncons, clr-wht, m-mnr crs, fr srt, inc biot, tr kaolin
--Sand: semi consol, calc, clr-wht, m-crs, inc biot, tr kaolin
--Sand: Same as above
TG 39 u--Sand: unconsol, clr-wht, m-crs, inc biot, tr kaolin
--Sand: fn-crs, predom m, mica
--Sand: m-crs, abund mica
--Sand: m-crs, f srt, subang-subrnd, mod sphere
--Sand: Same as above
--Sand: m-crs, subang-subrnd, clean
--Sand: m-crs, f srt, subang-subrnd, clean
--Sand: m-crs, thin intrbd biotite mica
--Siltstone: drk brn, fiss, frm fria, carb-vfn sndy, micromica
-- TG 9 u--Sand: m-crs, unconsol, qtz
RESUME ROTARY DRILLING AT 4816'
0
10000
100000
1000000
m-predom crs, subang, p srt, msv, mnr lign, tr lith acc, drk brn sltstn (<3%)
W 10.2 V 39 PV 19 YP 11
Gels 4/7/10 pH 8.0 F 3.6 Ck 1
Sol 10% Sd 1.0% Cl 500
Core Run #1, 4641' - 4666'
Recovered 22.8'
<== PROBABLE TOP
CAPAY FM
Core Run #2, 4666' - 4687'
Recovered 18.5'
<== PROBABLE TOP
MOKELUMNE FM
Core Run #3, 4687' - 4701'
Recovered 13.85'
Core Run #4, 4701' - 4731'
Recovered 28.2'
Sand: gry, brn, grn, unconsol, vfn-crs, m srt, lith, clr-mlky, vf-fn, w srt -occ fn-crs pr srt qtz, lt gry-brn, occ calc, stab-sblky sltstn, gry, adhsv, clys, lig, tr glau, mica
Core Run #5, 4731' - 4761'
Recovered 32.0'
(incl last 2 ft prev run)
Sand: clr-frstd, unconsol, vfn-crs, predom well sort med, subang-subrnd, qtz snd, <10% clys
Core Run #6, 4761' - 4791'
Recovered 28.8'
Sand: clr-frstd, predom unconsol, calc at 4785', vfn-crs, subang-subrnd, qtz snd, occ kaolin, <10% clys, abund biotite mica
Core Run #7, 4791' - 4816'
Recovered 27.4'
(incl last 2.4' of prev run)
Sand: clr-frstd, unconsol, fn-crs, predom med, qtz snd, <10% clys, brn, firm, fiss, micaceous, sltstn-vfn sndy sltstn at 4815'



Sand: clr, wht, gy, uncons, f-m gr, sbang-sbrnd, mod w srtd, vitr, semitransl, mod abdnt lg blk biot, mnr kaol cly, tr rndd smth volc lith frags, w/ abdnt thin wtry gy cly

W 10.2 V 39

Sand: clr, wht, gy, uncons, f-m gr, sbang-sbrnd, mod w srtd, vitr, semitransl, mod abdnt lg blk biot, mnr kaol cly, tr rndd smth volc lith frags, w/ abdnt thin wtry gy cly

Siltstone: m gy, p cons, sft, m gr, p srtd, abdnt hydtd intrstl cly, w/ abdnt unc qtz sd, mnr kaol cly, volc lith frags

Run Halliburton E Logs: RWCH, GTET, CSNG, SDL DSNT, ICT, BSAT, ACRT, XRMI, MRIL, RDT, SWC

Comments:

PG&E | "Piacentine" 2-27 | King Island Gas | Sec. 27, T3N-R5E; MDB&M

Geolog

FORMATION EVALUATION LOG

Scale: 2" = 100'

GR sh:	106		Deep Rsh:	5	ohm-m	Pressure:	2015.18	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[1600] - [2170] Zone02

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Limestone		PhiN sh:	0.454	fractions	Rw:	0.314	ohm-m
Rho ma:	2.71	gm/cc	Rho sh:	2	gm/cc	Rmf:	0.2	ohm-m
Dt ma:	48	us/ft	Dt sh:	114.25	us/ft	m:	2	
GR cl:	37		H20 Model:	Dual Water		n:	2	
GR sh:	103		Deep Rsh:	5	ohm-m	Pressure:	1641.07	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[2170] - [2950] Zone03

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Limestone		PhiN sh:	0.43	fractions	Rw:	0.291	ohm-m
Rho ma:	2.71	gm/cc	Rho sh:	1.927	gm/cc	Rmf:	0.2	ohm-m
Dt ma:	48	us/ft	Dt sh:	107.41	us/ft	m:	2	
GR cl:	44		H20 Model:	Dual Water		n:	2	
GR sh:	100		Deep Rsh:	5	ohm-m	Pressure:	1641.07	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[2950] - [3620] Zone04

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Limestone		PhiN sh:	0.441	fractions	Rw:	0.185	ohm-m
Rho ma:	2.71	gm/cc	Rho sh:	1.984	gm/cc	Rmf:	0.2	ohm-m
Dt ma:	48	us/ft	Dt sh:	97.6	us/ft	m:	2	
GR cl:	35		H20 Model:	Dual Water		n:	2	
GR sh:	170		Deep Rsh:	5	ohm-m	Pressure:	1641.07	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[3620] - [3790] Zone05

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Limestone		PhiN sh:	0.513	fractions	Rw:	0.18	ohm-m
Rho ma:	2.71	gm/cc	Rho sh:	1.985	gm/cc	Rmf:	0.2	ohm-m
Dt ma:	48	us/ft	Dt sh:	113.53	us/ft	m:	2	
GR cl:	44		H20 Model:	Dual Water		n:	2	
GR sh:	117		Deep Rsh:	5	ohm-m	Pressure:	1641.07	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[3790] - [4654] Domengine

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Calcareous Sandstone		PhiN sh:	0.316	fractions	Rw:	0.252	ohm-m
Rho ma:	2.68	gm/cc	Rho sh:	2.344	gm/cc	Rmf:	0.283	ohm-m
Dt ma:	52	us/ft	Dt sh:	92.47	us/ft	m:	1.7	
GR cl:	31		H20 Model:	Dual Water		n:	1.7	
GR sh:	274		Deep Rsh:	5	ohm-m	Pressure:	238.15	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[4654] - [4752] Capay Shale

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Calcareous Sandstone		PhiN sh:	0.433	fractions	Rw:	0.286	ohm-m
Rho ma:	2.68	gm/cc	Rho sh:	2.239	gm/cc	Rmf:	0.263	ohm-m
Dt ma:	52	us/ft	Dt sh:	82.03	us/ft	m:	2	
GR cl:	50		H20 Model:	Dual Water		n:	2	
GR sh:	181		Deep Rsh:	5	ohm-m	Pressure:	238.15	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[4752] - [4860] Mokelumne

Neutron Type	Auto Select		Vsh Choice:	GR - Stieber		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Calcareous Sandstone		PhiN sh:	0.406	fractions	Rw:	0.214	ohm-m
Rho ma:	2.68	gm/cc	Rho sh:	2.292	gm/cc	Rmf:	0.251	ohm-m
Dt ma:	52	us/ft	Dt sh:	74.29	us/ft	m:	1.8	
GR cl:	64		H20 Model:	Dual Water		n:	1.8	
GR sh:	170		Deep Rsh:	5	ohm-m	Pressure:	238.15	psi
SP cl:	10		Shal Rsh:	5	ohm-m			
SP sh:	90		Porosity:	Best [DNS]				

[4860] - [4900] Base Mokelumne Shale

Neutron Type	Auto Select		Vsh Choice:	SP		Sonic Eq.:	Time-Series (Wylie)	
Lithology:	Calcareous Sandstone		PhiN sh:	0.433	fractions	Rw:	0.178	ohm-m

Rho ma:	2.68	gm/cc	Rho sh:	2.218	gm/cc	Rmf:	0.2	ohm-m
Dt ma:	52	us/ft	Dt sh:	93.73	us/ft	m:	2	
GR cl:	73		H20 Model:	Dual Water		n:	2	
GR sh:	164		Deep Rsh:	5	ohm-m	Pressure:	238.15	psi
SP cl:	-98.9		Shal Rsh:	5	ohm-m			
SP sh:	-40.1		Porosity:	Best [DNS]				

Reservoir Net Pay Parameters (In-Depth Calculations)

Gross Range: [550] - [4983] Interval Analyzed: [610] - [4900]

				Gross Interval	Net Pay	
[3790] - [4654] DOMENGINE						
Ignore Coal:	no		h:	864 [0.250 to 0.250]	[N/A] [-999.250 to -999.250]	ft
Dev Factor:	1	(0)	Phi:	0.292585 [0.000 to 0.380]	[N/A] [-999.250 to -999.250]	fractions
Phi Cutoff:	10-50	%	Phi * h:	252.79	[N/A]	ft
Sw Cutoff:	0-50	%	Sw:	0.832971 [0.572 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Vsh Cutoff:	0-25	%	Sxo:	0.841847 [0.607 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Perm Cutoff:	0-100000	MD	Vsh:	0.102192 [0.000 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Min Perm.:	0	MD	In-place HC:	42.22	[N/A]	ft
[N/A] Cutoff:	0-0		Rec HC:	2.24	[N/A]	ft
Volumetric Calculations:			In-place Gas:	24523.6716	[N/A]	MMCF
Type of Res:	Gas		Rec Gas:	19618.9372	[N/A]	MMCF
Drain Area:	40	ACRE	LCalc Rec Gas:	1303.1852	[N/A]	MMCF
Oil FVF:	1.3	RB/STB	Perm (Harm):	0.001 [0.000 to 1887.0]	[N/A] [-999.250 to -999.250]	MD
Gas FVF:	0.003	RCF/SCF	Perm (Geom):	203.5 [0.000 to 1887.0]	[N/A] [-999.250 to -999.250]	MD
Rec Factor:	0.8	fractions	Perm (Arith):	371.7 [0.000 to 1887.0]	[N/A] [-999.250 to -999.250]	MD
			Rho Cma:	2.7 [2.620 to 2.958]	[N/A] [-999.250 to -999.250]	gm/cc
Net Sand/Gross Sand h:		0.992	Dt Cma:	45.8 [37.80 to 72.25]	[N/A] [-999.250 to -999.250]	us/ft
Net Pay/Gross Sand h:		-1.207	U Cma:	8.2 [5.923 to 13.44]	[N/A] [-999.250 to -999.250]	b/cm3
Net Pay/Net Sand h:		-1.217				
[4654] - [4752] CAPAY SHALE						
Ignore Coal:	no		h:	98 [0.250 to 0.250]	[N/A] [-999.250 to -999.250]	ft
Dev Factor:	1	(0)	Phi:	0.165971 [0.000 to 0.337]	[N/A] [-999.250 to -999.250]	fractions
Phi Cutoff:	10-50	%	Phi * h:	16.27	[N/A]	ft
Sw Cutoff:	0-50	%	Sw:	0.928226 [0.746 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Vsh Cutoff:	0-25	%	Sxo:	0.939319 [0.810 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Perm Cutoff:	0-100000	MD	Vsh:	0.459977 [0.000 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Min Perm.:	0	MD	In-place HC:	1.17	[N/A]	ft
[N/A] Cutoff:	0-0		Rec HC:	0.18	[N/A]	ft
Volumetric Calculations:			In-place Gas:	678.0313	[N/A]	MMCF
Type of Res:	Gas		Rec Gas:	542.425	[N/A]	MMCF
Drain Area:	40	ACRE	LCalc Rec Gas:	104.7947	[N/A]	MMCF
Oil FVF:	1.3	RB/STB	Perm (Harm):	0 [0.000 to 724.0]	[N/A] [-999.250 to -999.250]	MD
Gas FVF:	0.003	RCF/SCF	Perm (Geom):	1.63 [0.000 to 724.0]	[N/A] [-999.250 to -999.250]	MD
Rec Factor:	0.8	fractions	Perm (Arith):	80.35 [0.000 to 724.0]	[N/A] [-999.250 to -999.250]	MD
			Rho Cma:	2.89 [2.694 to 3.083]	[N/A] [-999.250 to -999.250]	gm/cc
Net Sand/Gross Sand h:		1	Dt Cma:	40.1 [35.02 to 59.87]	[N/A] [-999.250 to -999.250]	us/ft
Net Pay/Gross Sand h:		-31.976	U Cma:	10.3 [7.857 to 16.98]	[N/A] [-999.250 to -999.250]	b/cm3
Net Pay/Net Sand h:		-31.976				
[4752] - [4860] MOKELUMNE						
Ignore Coal:	no		h:	108 [0.250 to 0.250]	[N/A] [-999.250 to -999.250]	ft
Dev Factor:	1	(0)	Phi:	0.206879 [0.000 to 0.360]	[N/A] [-999.250 to -999.250]	fractions
Phi Cutoff:	10-50	%	Phi * h:	22.34	[N/A]	ft
Sw Cutoff:	0-50	%	Sw:	0.845769 [0.582 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Vsh Cutoff:	0-25	%	Sxo:	0.864337 [0.679 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Perm Cutoff:	0-100000	MD	Vsh:	0.363602 [0.016 to 1.000]	[N/A] [-999.250 to -999.250]	fractions
Min Perm.:	0	MD	In-place HC:	3.45	[N/A]	ft
[N/A] Cutoff:	0-0		Rec HC:	0.41	[N/A]	ft
Volumetric Calculations:			In-place Gas:	2001.4193	[N/A]	MMCF
Type of Res:	Gas		Rec Gas:	1601.1354	[N/A]	MMCF
Drain Area:	40	ACRE	LCalc Rec Gas:	240.9528	[N/A]	MMCF
Oil FVF:	1.3	RB/STB	Perm (Harm):	0 [0.000 to 1216.9]	[N/A] [-999.250 to -999.250]	MD
Gas FVF:	0.003	RCF/SCF	Perm (Geom):	15.88 [0.000 to 1216.9]	[N/A] [-999.250 to -999.250]	MD
Rec Factor:	0.8	fractions	Perm (Arith):	220 [0.000 to 1216.9]	[N/A] [-999.250 to -999.250]	MD
			Rho Cma:	2.75 [2.562 to 2.958]	[N/A] [-999.250 to -999.250]	gm/cc
Net Sand/Gross Sand h:		0.996	Dt Cma:	50.4 [35.09 to 78.47]	[N/A] [-999.250 to -999.250]	us/ft
Net Pay/Gross Sand h:		-17.531	U Cma:	9.2 [7.011 to 12.30]	[N/A] [-999.250 to -999.250]	b/cm3
Net Pay/Net Sand h:		-17.608				
[4860] - [4900] BASE MOKELUMNE SHALE						
Ignore Coal:	no		h:	40 [0.250 to 0.250]	[N/A] [-999.250 to -999.250]	ft
Dev Factor:	1	(0)	Phi:	0.254213 [0.046 to 0.322]	[N/A] [-999.250 to -999.250]	fractions
Phi Cutoff:	10-50	%	Phi * h:	10.17	[N/A]	ft
Sw Cutoff:	0-50	%	Sw:	0.926394 [0.803 to 1.000]	[N/A] [-999.250 to -999.250]	fractions

HALLIBURTON

COMPENSATED SPECTRAL NATURAL GAMMA

5"=100'

COMPANY PG&E
WELL PIACENTINE 2-27
FIELD/BLOCK KING ISLANDS GAS
COUNTY SAN JOAQUIN STATE CA

API No. 04-077-20736
Location LAT: 38.08155572
LONG:121.422162329
Sect. 27 Twp. 3N Rge. 5E

Other Services:
RWCH
BSAT
ICT
MRIL
XRMI
RDT / SWC
ACRT / SDL / DSN

Permanent Datum	GL	Elev. -4.5 ft	Elev.: K.B. 7.5 ft
Log measured from	KB	, 12.0 ft above perm. Datum	D.F. 0.0 ft
Drilling measured from	KB		G.L. -4.5 ft

Date		24-Mar-13					
Run No.		1					
Depth - Driller		4970.00 ft					
Depth - Logger		4972.0 ft					
Bottom - Logged Interval		4878.0 ft					
Top - Logged Interval		613.0 ft					
Casing - Driller		9.625 in	@ 613.0 ft	@		@	
Casing - Logger		613.0 ft					
Bit Size		8.500 in		@		@	
Type Fluid in Hole		LSND					
Density	Viscosity	10.2 ppg	38.00 s/qt				
PH	Fluid Loss	8.00 pH	3.9 cptm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		3.400 ohmm	@ 72.00 degF	@		@	
Rmf @ Meas. Temperature		2.71 ohmm	@ 69.00 degF	@		@	
Rmc @ Meas. Temperature		4.620 ohmm	@ 69.00 degF	@		@	
Source Rmf	Rmc	MEAS	MEAS				
Rm @ BHT		2.06 ohmm	@ 123.0 degF	@		@	
Time Since Circulation		6.1 hr					
Time on Bottom		24-Mar-13 23:06					
Max. Rec. Temperature		123.0 degF	@ N/A	@		@	
Equipment	Location	11871069	BKSFLD				
Recorded By		D. SANDOVAL					
Witnessed By		FRANK B. CRESSY					

Fold here

Service Ticket No.: 900310522 API Serial No.: 04-077-20736 PGM Version: WL INSITE R3.8.4 (Build 5)

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE

Date							
Sample No.							
Depth-Driller							
Type Fluid in Hole							
Density	Viscosity						
Ph	Fluid Loss						
Source of Sample							
Rm @ Meas. Temp		@	@	@	@	@	@
Rmf @ Meas. Temp.		@	@	@	@	@	@
Rmc @ Meas. Temp.		@	@	@	@	@	@
Source Rmf	Rmc						
Rm @ BHT		@	@	@	@	@	@
Rmf @ BHT		@	@	@	@	@	@
Rmc @ BHT		@	@	@	@	@	@

RESISTIVITY SCALE CHANGES

Type Log							
Depth							
Scale Up Hole							
Scale Down Hole							

RESISTIVITY EQUIPMENT DATA

Run No.		ONE					
Tool Type & No.		ACRT	I 10832951	S 10809609			
Pad Type		NA					
Tool Pos.	1.5"						
Other	NA						

EQUIPMENT DATA

GAMMA		ACOUSTIC		DENSITY		NEUTRON	
Run No.	ONE	Run No.	ONE	Run No.	ONE	Run No.	ONE
Serial No.	11534457	Serial No.	10939059	Serial No.	10746645	Serial No.	10971182
Model No.	GTET	Model No.	BSAT	Model No.	SDLT	Model No.	DSNT
Diameter	3.625"	No. of Cent.	2	Diameter	4.75"	Diameter	3.625"
Detector Model No.	GTET	Spacing	NA	Log Type	GAM-GAM	Log Type	NEU-NEU
Type	SCINT			Source Type	Cs 137	Source Type	Am241Be
Length	8.0"	LSA [Y/N]	NA	Serial No.	5492GW	Serial No.	DSN 306
Distance to Source	N/A	FWDA [Y/N]	NA	Strength	1.5 CI	Strength	15 CI

LOGGING DATA

GENERAL				GAMMA		ACOUSTIC			DENSITY			NEUTRON		
Run	Depth		Speed	Scale		Scale		Matrix	Scale		Matrix	Scale		Matrix
No.	From	To	ft/min	L	R	L	R		L	R		L	R	
ONE	4972'	613'	REC	0	150				1.65	2.65	2.65	60	0	SAND

DIRECTIONAL INFORMATION

Maximum Deviation @ KOP @

Remarks:

ACRT/BSAT/ICT/SDL/DSN/CSNG/GR/RWCH RUN IN COMBINATION

SDL VOLUMES (ft^3) CALCULATED FOR A 5.5" CASING FROM TD TO SHOE: AHVT: 1043 BHVT: 1764

ICT VOLUMES (ft^3) CALCULATED FOR A 5.5" CASING FROM TD TO SHOE: AHVT: 1097 BHVT: 1818

DSNT CLASS POROSITY PARAMETER ENABLED.

CREW: F. VARGAS, B. CONTRERAS, A. VAZQUEZ RIG: PG 4

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

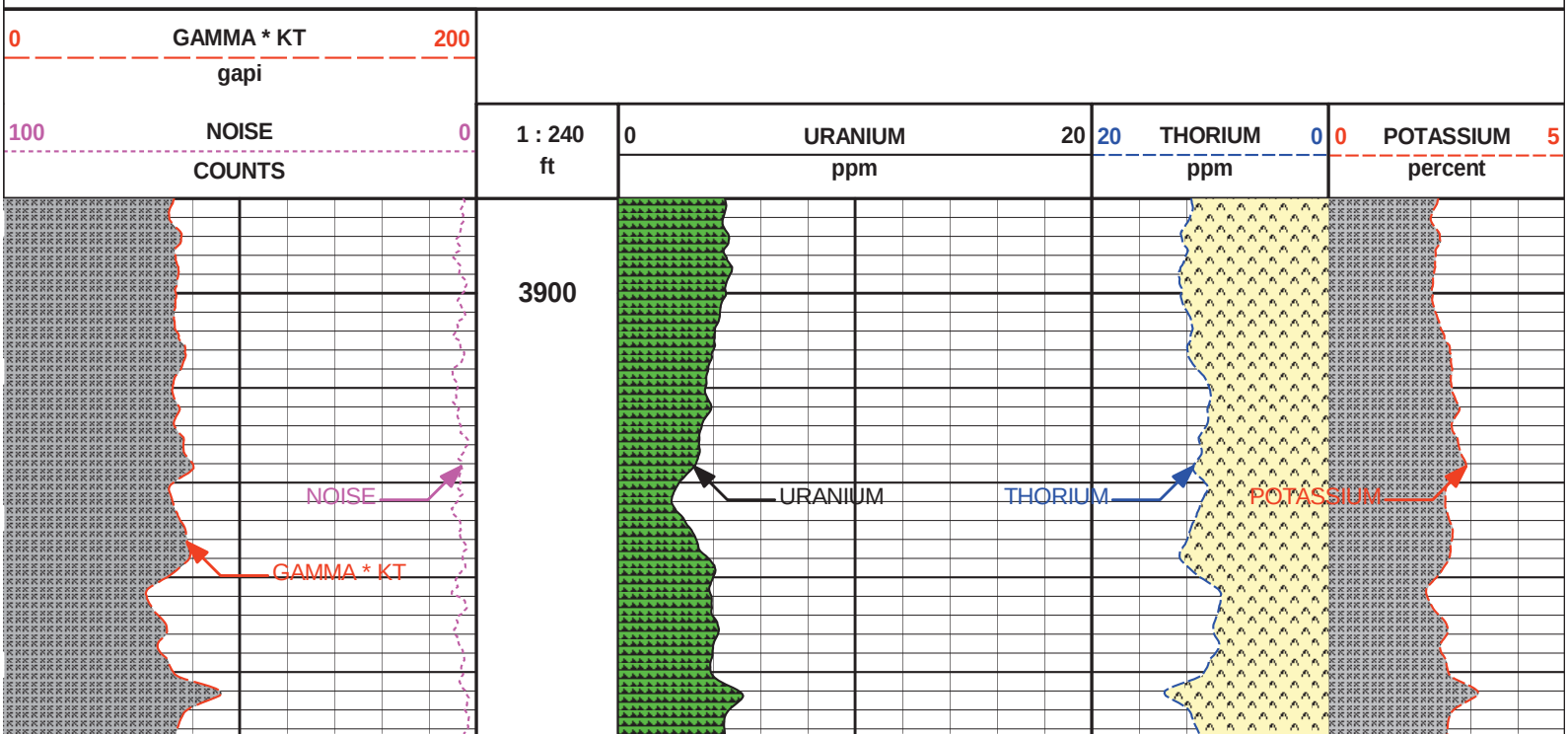
HALLIBURTON

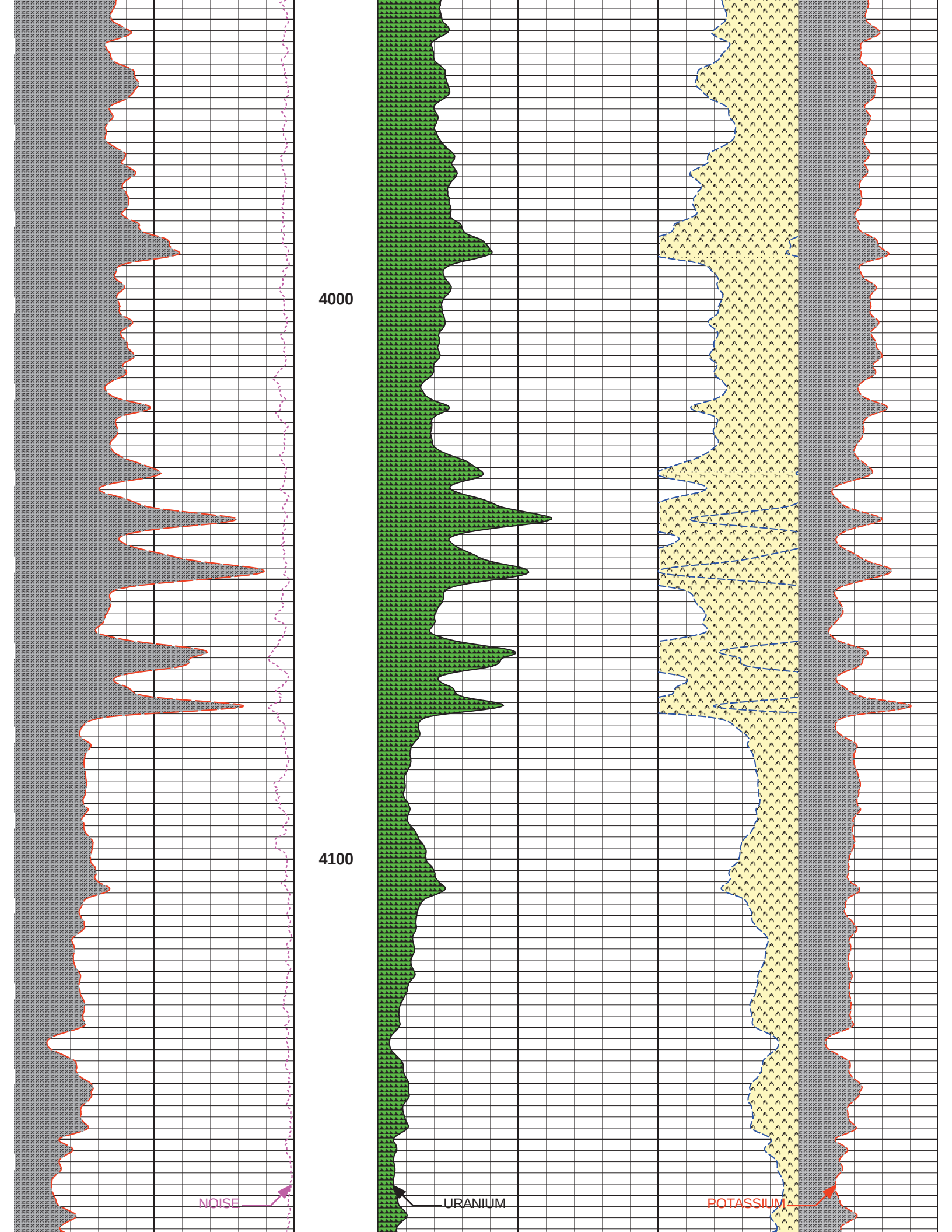
HALLIBURTON

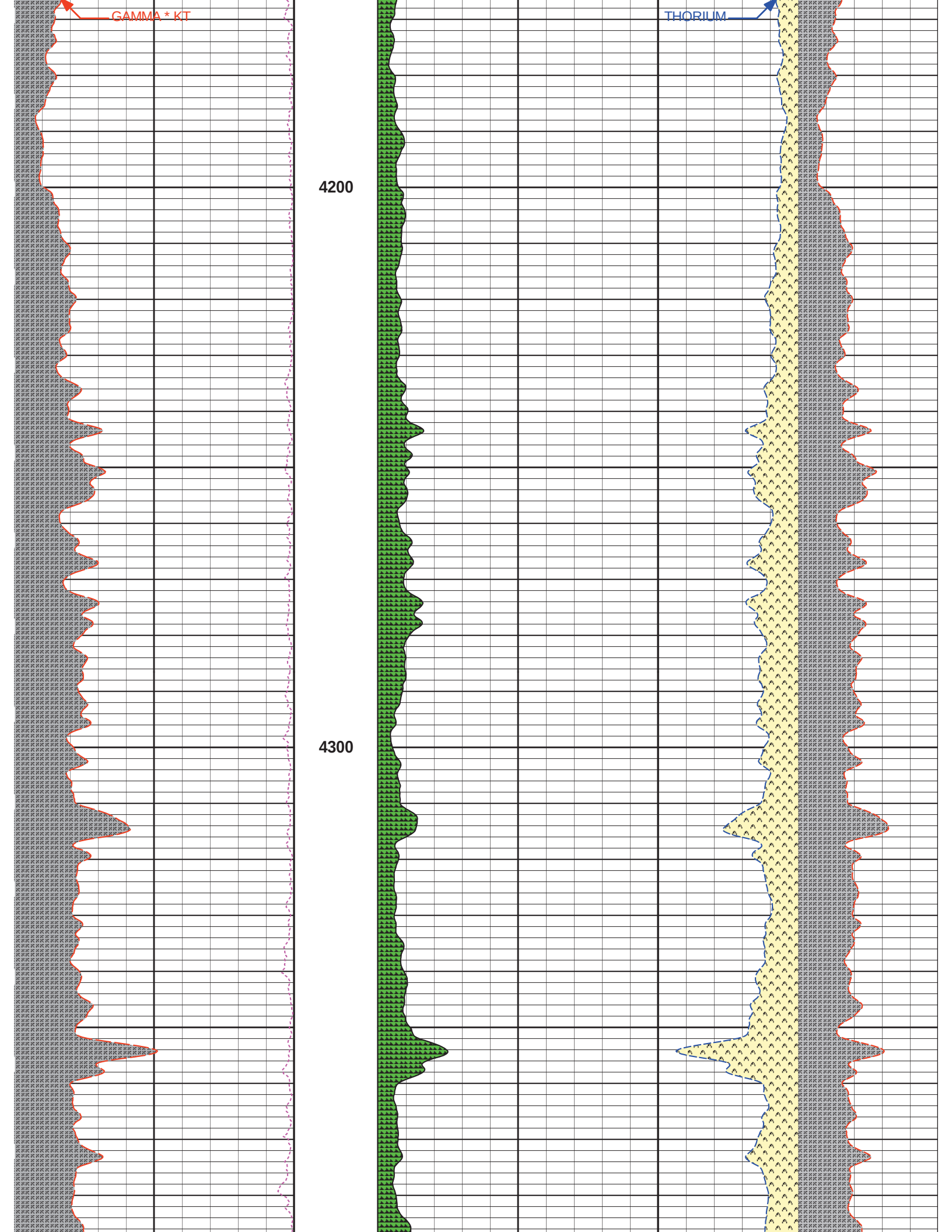
Plot Time: 25-Mar-13 02:44:36
Plot Range: 3890 ft to 4983 ft
Data: PIACENTINE 2-27\Well Based\DAQ-0001-002.01
Plot File: \\CSNG_PLOT\OXY - CSNG PRIMARY

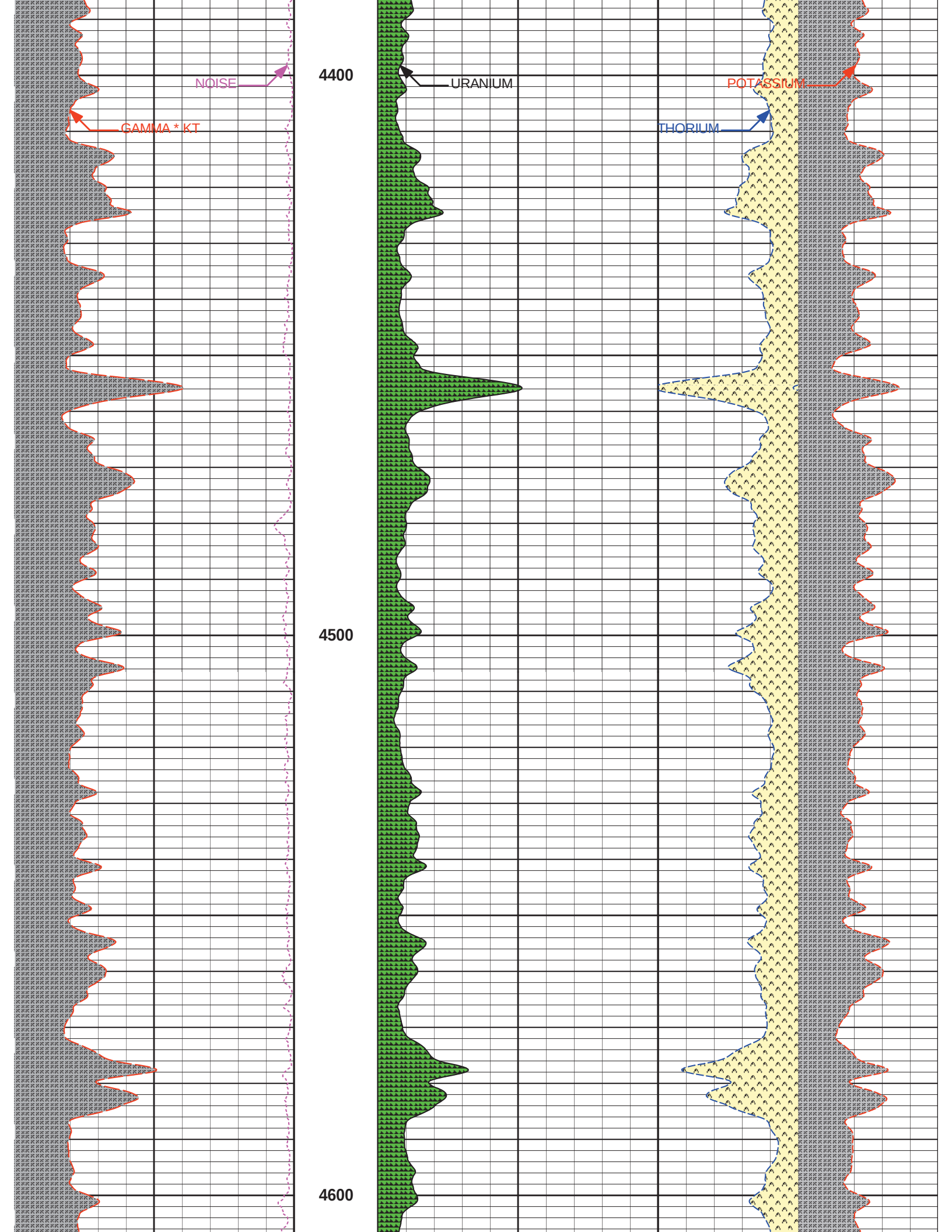
PRIMARY PASS

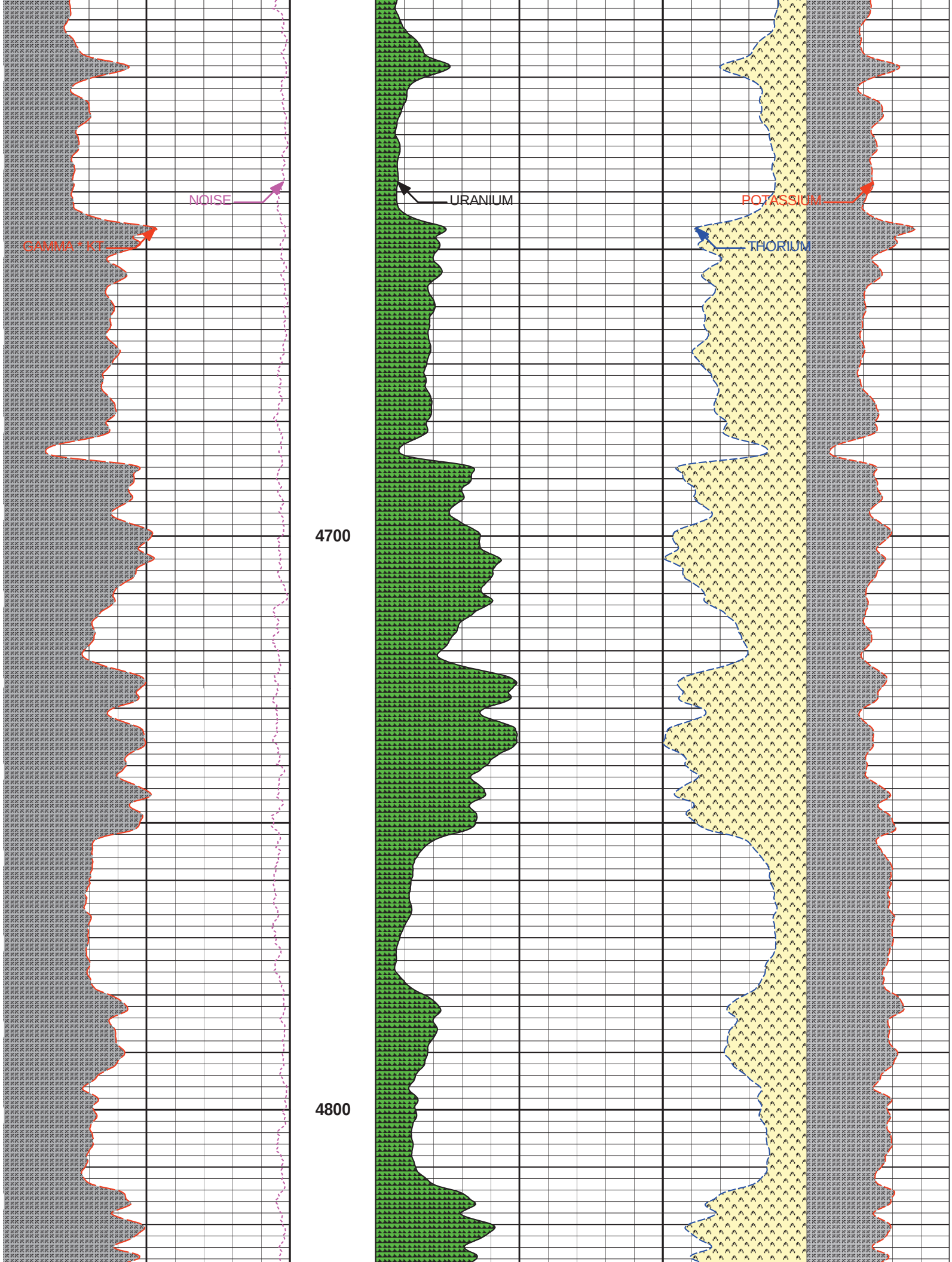
5" = 100'

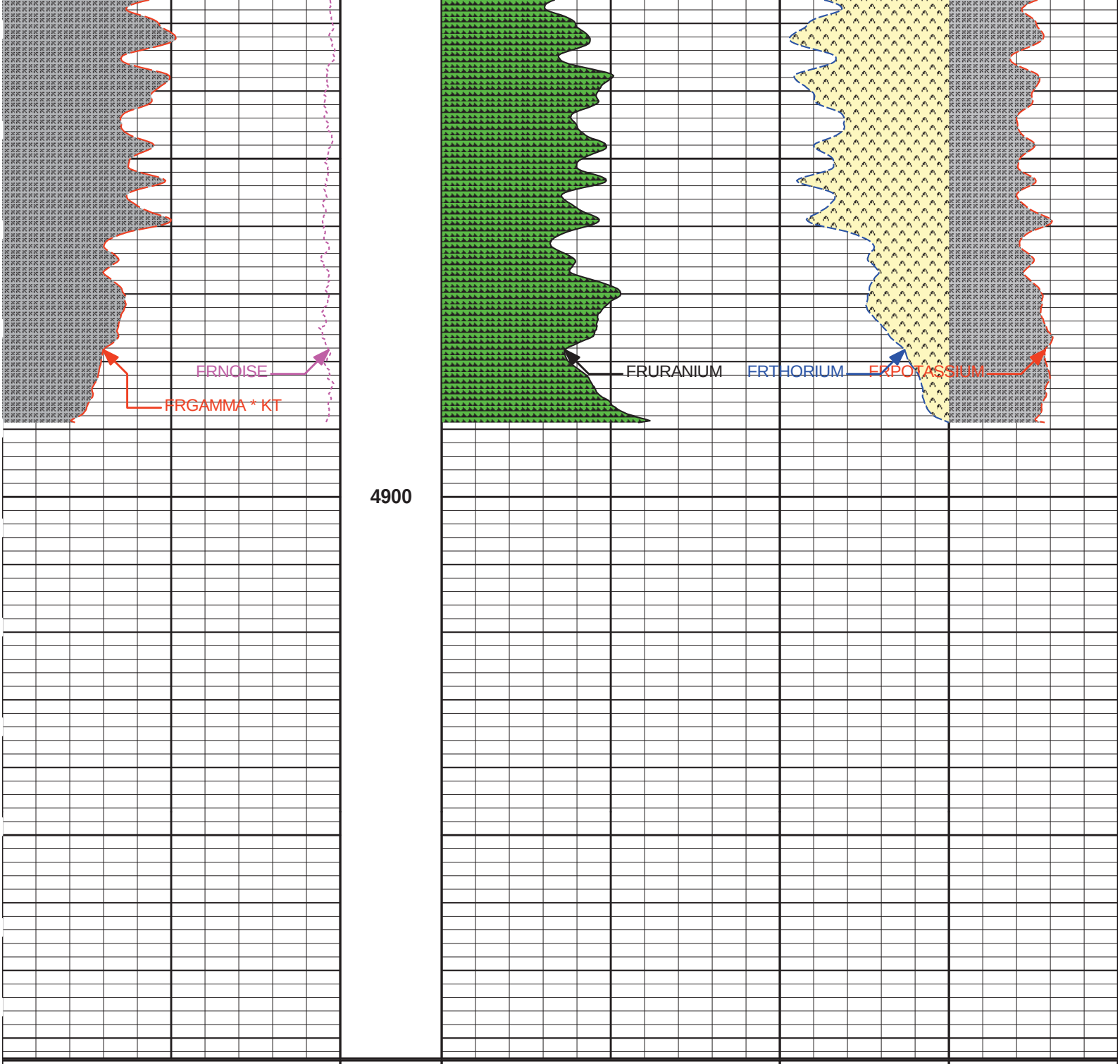



4000
4100
NOISE
URANIUM
POTASSIUM


GAMMA * KT
THORIUM
4200
4300


NOISE
GAMMA * KT
4400
URANIUM
POTASSIUM
THORIUM
4500
4600


NOISE
GAMMA * KT
URANIUM
POTASSIUM
THORIUM
4700
4800



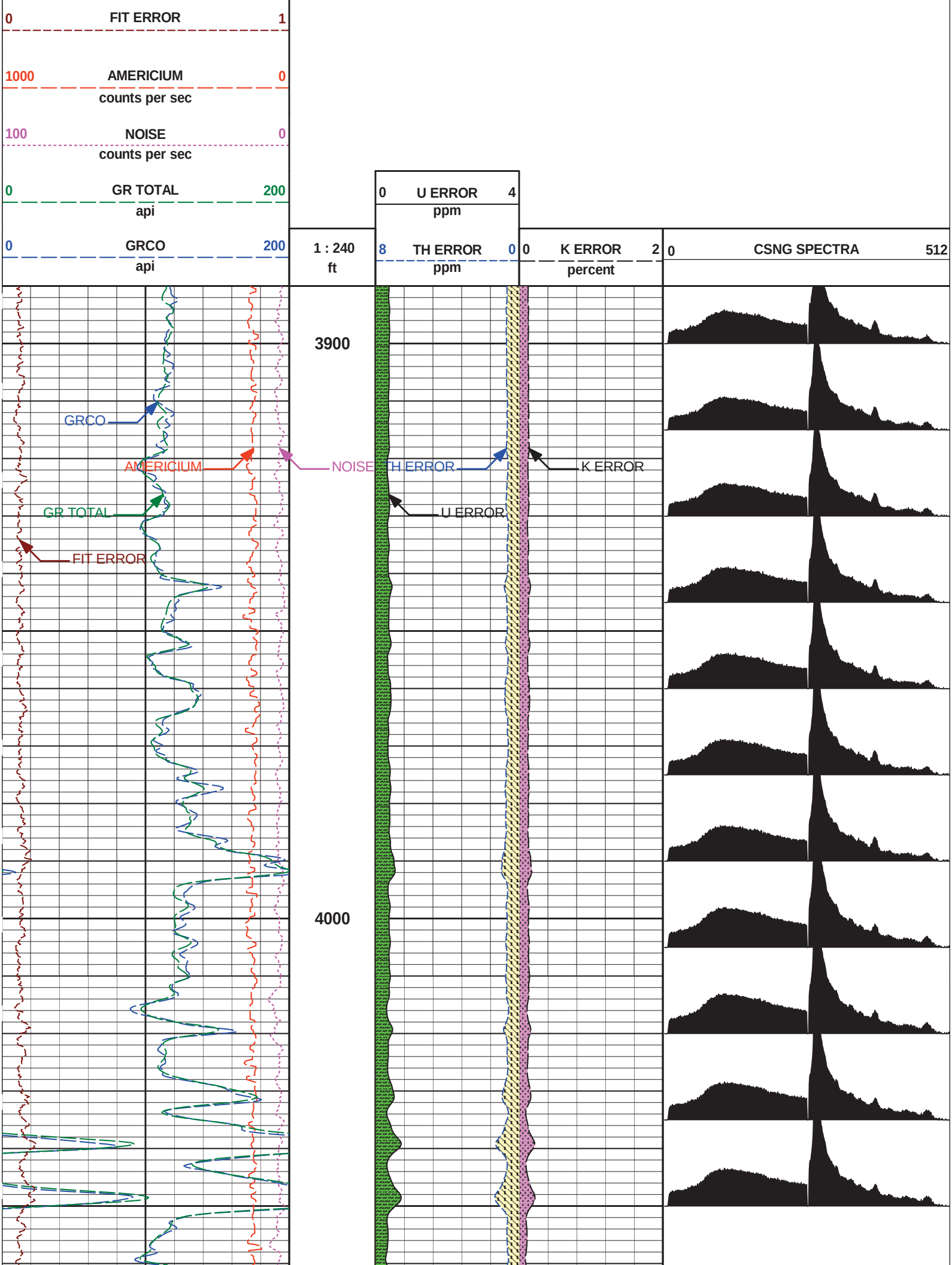
100 NOISE 0	1 : 240 ft	0 URANIUM 20	20 THORIUM 0	0 POTASSIUM 5
COUNTS		ppm	ppm	percent
0 GAMMA * KT 200				
gapi				

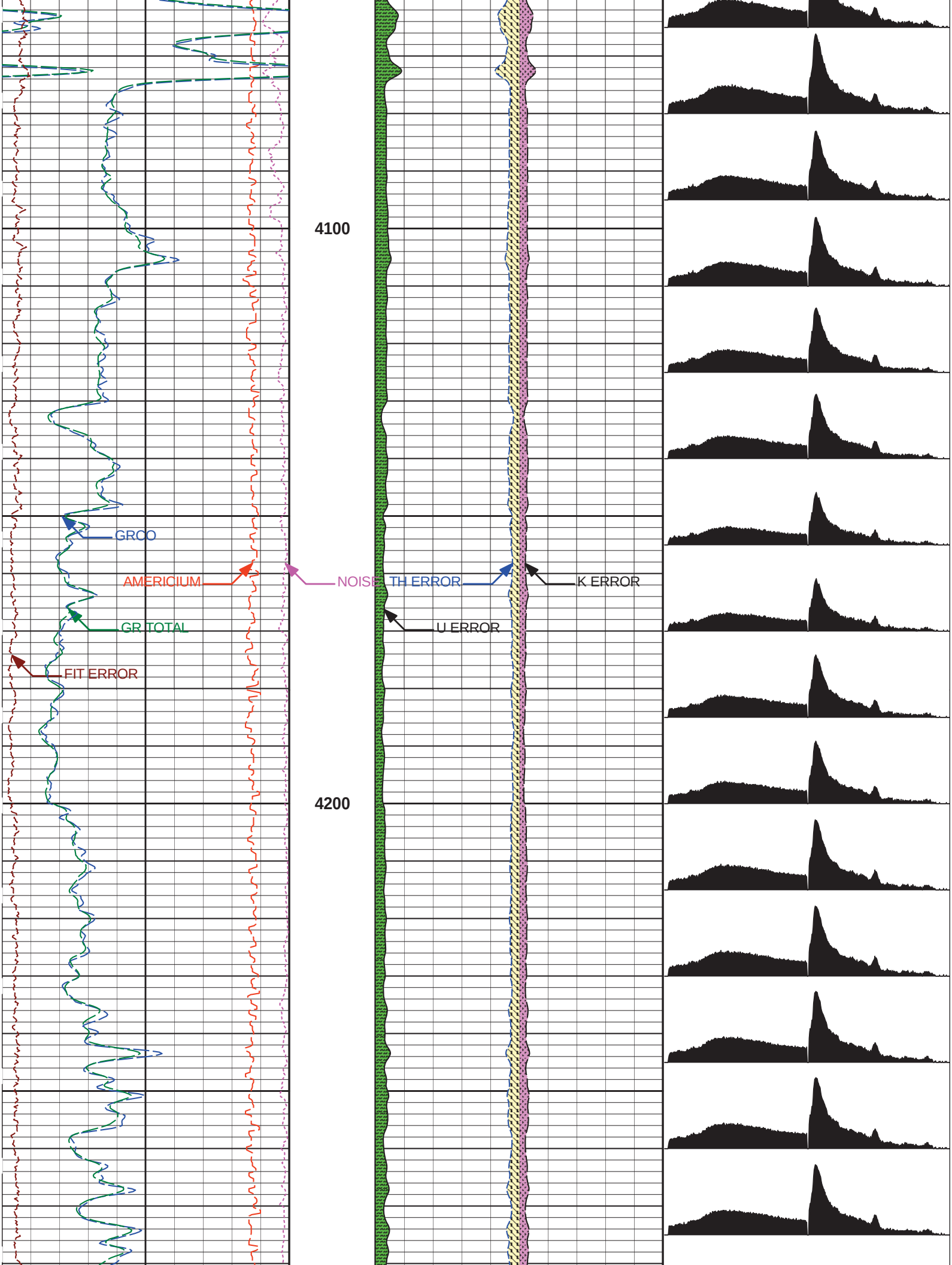
HALLIBURTON

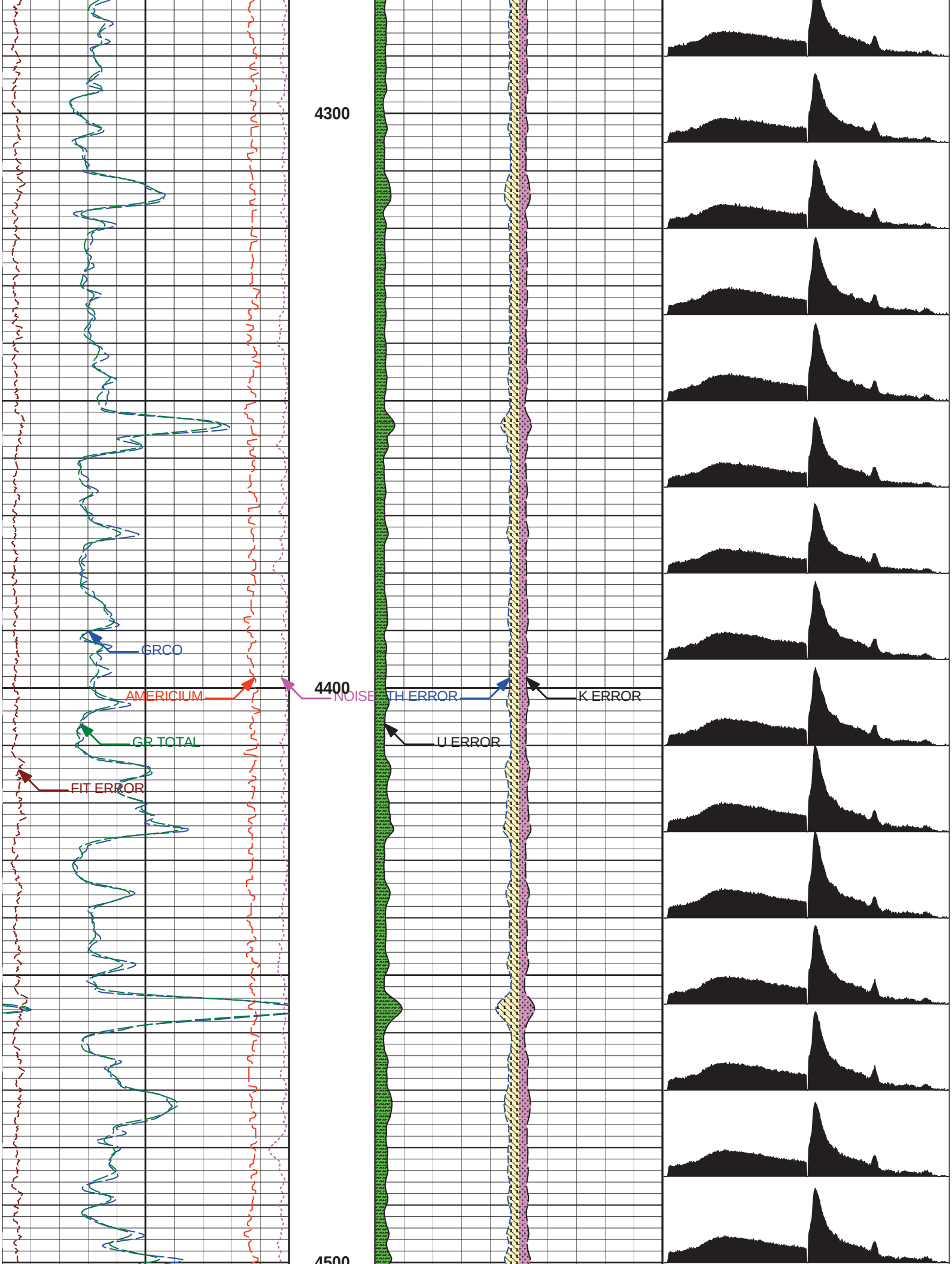
Plot Time: 25-Mar-13 02:44:38
Plot Range: 3890 ft to 4983 ft
Data: PIACENTINE 2-27\Well Based\DAQ-0001-002.01\
Plot File: \\CSNG_PLOT\OXY - CSNG QUALITY

QUALITY PASS

5" = 100'


0 FIT ERROR 1
1000 AMERICIUM 0
counts per sec
100 NOISE 0
counts per sec
0 GR TOTAL 200
api
0 GRCO 200
api
1 : 240
ft
0 U ERROR 4
ppm
8 TH ERROR 0
ppm
0 K ERROR 2
percent
0 CSNG SPECTRA 512
3900
4000
GRCO
AMERICIUM
NOISE
TH ERROR
K ERROR
GR TOTAL
U ERROR
FIT ERROR


4100
4200
GRCO
AMERICIUM
NOISE
TH ERROR
K ERROR
GR TOTAL
U ERROR
FIT ERROR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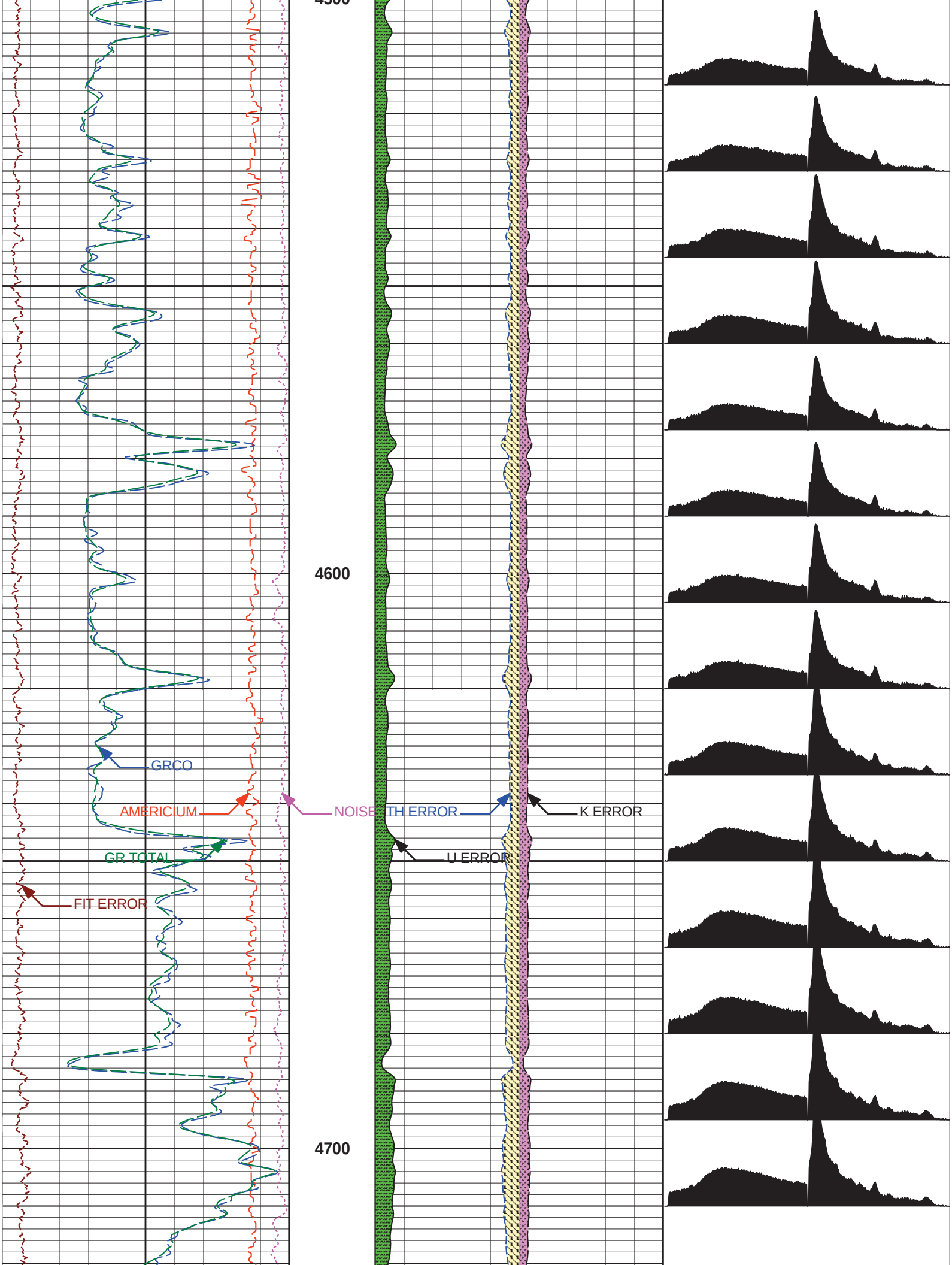
4400
4500
GRCO
AMERICIUM
NOISE
TH ERROR
K ERROR
GR TOTAL
U ERROR
FIT ERROR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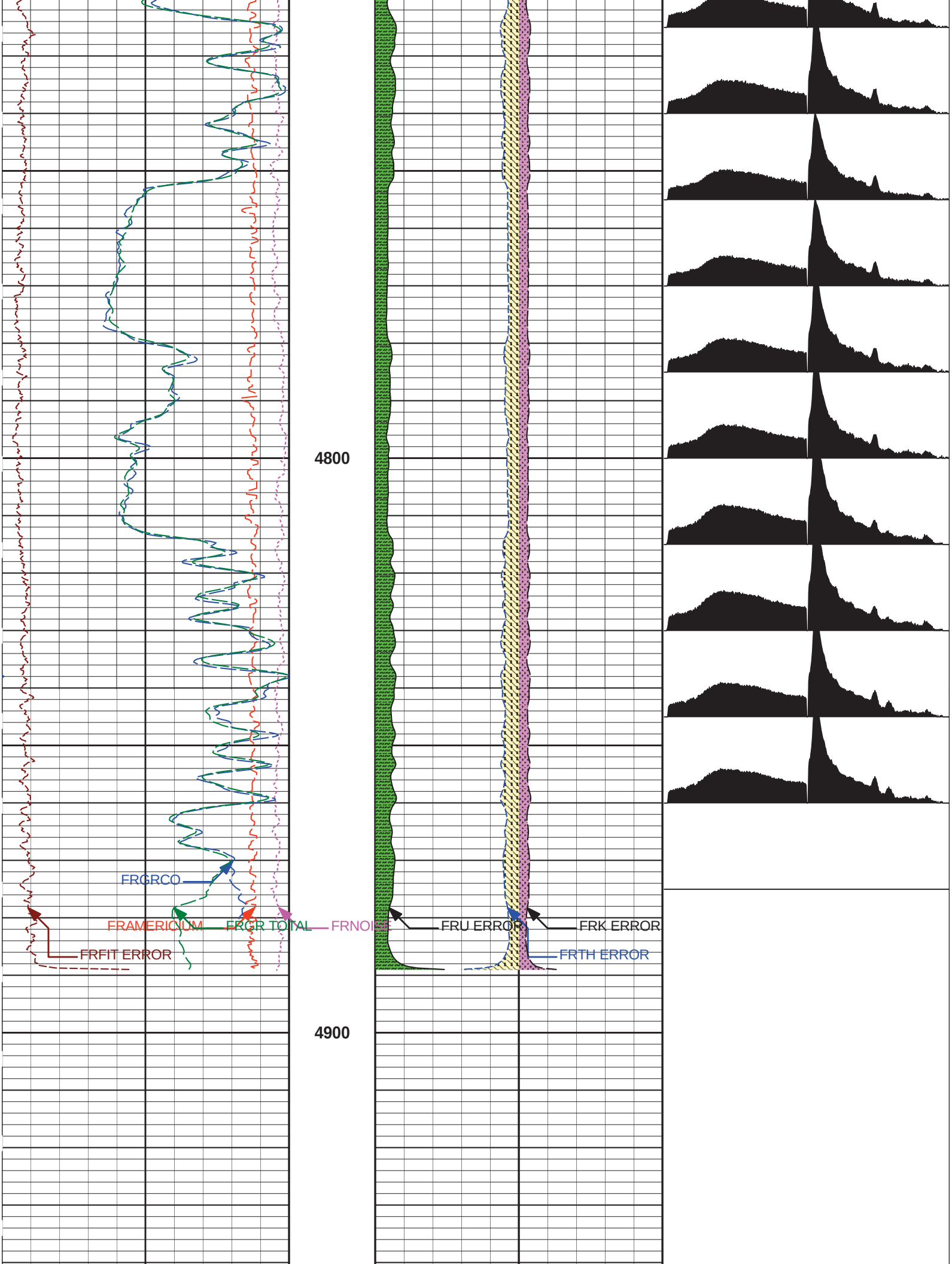
4600
4700
GRCO
AMERICIUM
NOISE
TH ERROR
K ERROR
U ERROR
GR TOTAL
FIT ERROR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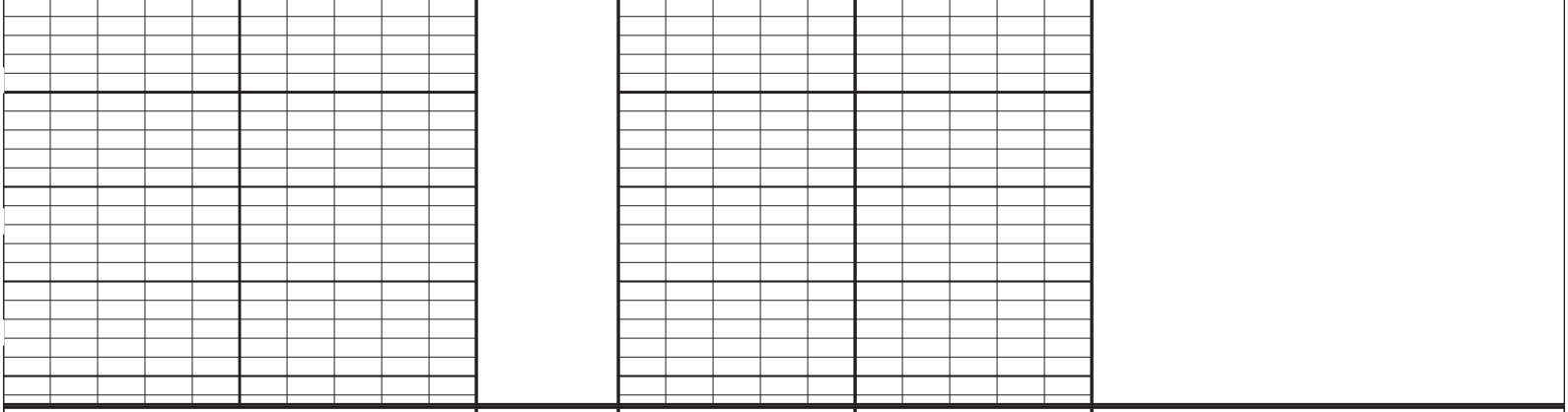
4900
FRGRCO
FRAMERICIUM
FRGR TOTAL
FRNOISE
FRFIT ERROR
FRU ERROR
FRK ERROR
FRTH ERROR



0 GRCO 200 api	1 : 240 ft	8 TH ERROR 0 ppm	0 K ERROR 2 percent	0 CSNG SPECTRA 512	
0 GR TOTAL 200 api		0 U ERROR 4 ppm			
100 NOISE 0 counts per sec					
1000 AMERICIUM 0 counts per sec					
0 FIT ERROR 1					

COMPANY	**PG&E**
WELL	**PIACENTINE 2-27**
FIELD	**KING ISLANDS GAS**
COUNTY	**SAN JOAQUIN** STATE **CA**

HALLIBURTON

COMPENSATED SPECTRAL NATURAL GAMMA

5"=100'

HALLIBURTON

GAMMA RAY NEUTRON RADIAL CEMENT BOND LOG

(GR-N-RCBL)

Company PG&E
Well PIACETINE 2-27
Field KING ISLAND GAS
County SAN JOAQUIN State CALIF.

API No.: 04-077-20736 Serv #: 900417029

Location: X: 1734574.00
Y: 577271.00
NAD 27 ZONE 3
LAT: 38.08155572
LONG: 121.422162329

Sec: 27 Twp: 3N Rge: 5E

Other Services

NONE

Permanent Datum	G.L.	Elevation	-4.5'
Log Measured From	K.B. , 12.0 Ft. above perm. datum		
Drilling Measured From	K.B.		

Elevation
K.B. 7.5'
D.F. ----
G.L. -4.5'

Date @ Time Logged	05/06/2013 @ 0900 HRS	Type Fluid in Hole	WATER
Run No.	ONE	Density of Fluid	8.45#
Depth - Driller	4920' E.D.	Fluid Level	SURFACE
Depth - Logger	4868'	Cement Top Est. Logged	N/A
Bottom - Logged Interval	4866'	Equipment / Location	10678535 / BKSFD
Top - Log Interval	SURFACE	Recorded by	DAN DUTY
Max. Recorded Temp.	N/A	Witnessed by	MR. C. EMOND

CEMENTING DATA	Surface String	Protection String	Production String	Liner
Date / Time Cemented			03/2013	
Primary / Squeeze			PRIMARY	
Expected Compressive Strength	psi@ hrs	psi@ hrs	psi@ hrs	psi@ hrs
Cement Volume				
Cement Type / Weight	/	/	/	/
Formulation			SEE REMARKS	
Mud Type / Mud Wgt.	/	/	/	/

Borehole Record				Casing & Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To
ONE	N/A	SURFACE	613'	9.625"	36.0#	SURFACE	613'
TWO	8.5"	613'	4970'	5.5"	15.5#	SURFACE	4969'
				FLOAT	COLLAR		4920'
				FLAG	JOINT	4717'	4727'

<< Fold Here >>>

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

Comments

LOG IS ON DEPTH TO H.E.S. GR-ARRAY-RES-SDL-DSN DATED 03/24/2013
GAMMA RAY AND NEUTRON USED FOR CORRELATION PURPOSE ONLY.
NO CEMENT INFORMATION AVAILABLE AT THIS TIME.

" THANK YOU FOR CHOOSING HALLIBURTON ENERGY SERVICES "
YOUR CREW FOR TODAY: Z. LONGORIA; S. ONTIVEROS
MBU. #BK0606
RIG: HES MAST

Service Ticket No. 900417029 API No. 077-20736 PGM Ver 111027_R4

The Well Name, Location, Borehole Description, and / or Cementing Data Furnished by Client

EQUIPMENT DATA

GAMMA	CBL	NEUTRON	SOURCE
Run No. ONE	Run No. ONE	Run No. ONE	Run No. ONE

Company PG&E
Well PIACETINE 2-27
Field KING ISLAND GAS
County SAN JOAQUIN State CALIF.

Run No.	ONE	Run No.	ONE	Run No.	ONE	Run No.	ONE
Serial No.	11368007	Serial No.	11923960	Serial No.	11368007	Serial No.	T-169
Model No.	PRB-GR	Model No.	RCBL	Model No.	PRB-NEU	Model No.	AM241BE
Diameter	2.75"	Diameter	2.75"	Diameter	2.75"	Diameter	5 CIS

LOGGING DATA

General Data

Pass	Depths		Well Head	Speed	Logging Run Comments
No.	From	To	Pressure	Ft/Min	
ONE	4866'	4650'	0 PSI	45'	REPEAT
TWO	4866'	SURFACE	0 PSI	45'	MAIN

	GAMMA		CBL		NEUTRON			
Pass	Scale		Scale		Scale		Scale	
No.	L	R	L	R	L	R	L	L
ONE	0	150	200	1200	0	600		
TWO	0	150"	200	1200	0	600		

DIRECTIONAL INFORMATION

Maximum Deviation		deg. @		KOP		

Company PG&E
Well PIACETINE 2-27
Field KING ISLAND GAS
County SAN JOAQUIN State CALIF.

HALLIBURTON

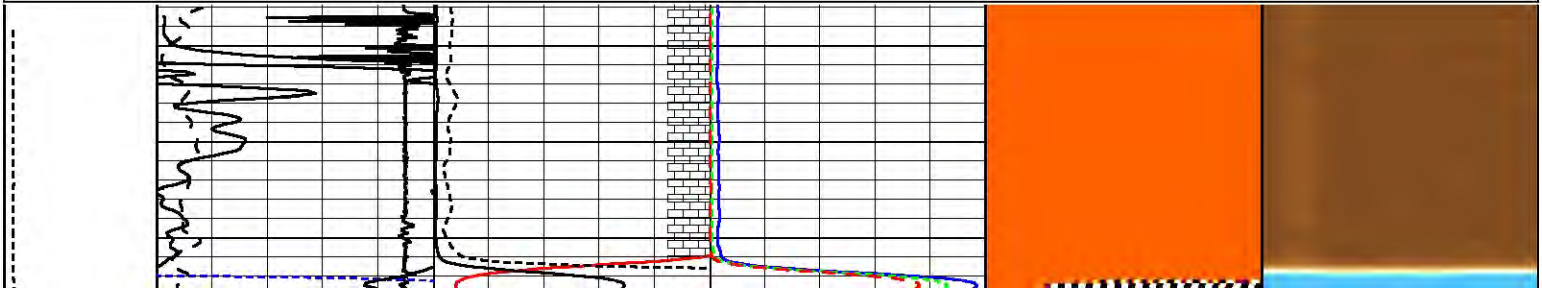
GAMMA RAY NEUTRON
RADIAL CEMENT
BOND LOG

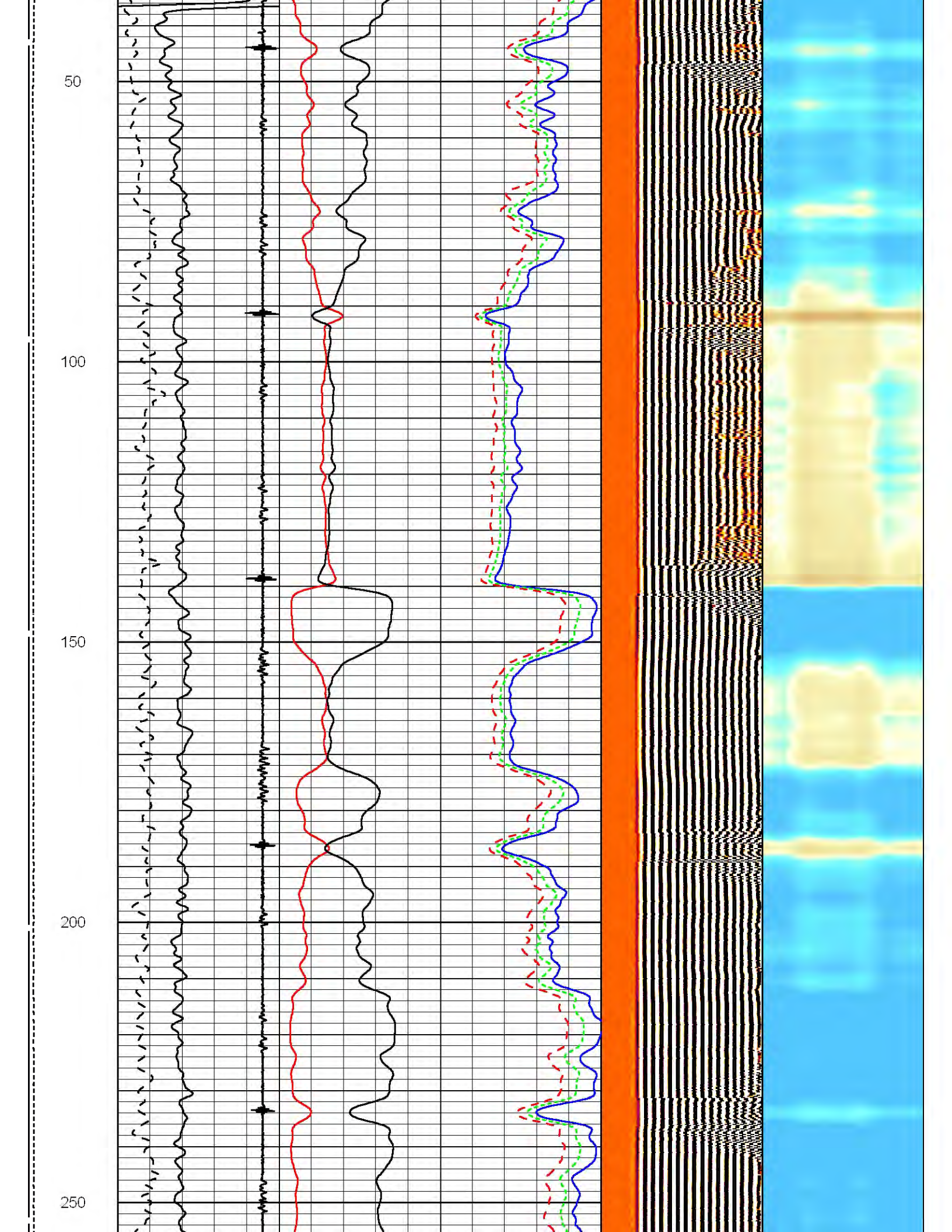
HALLIBURTON

MAIN PASS LOGGED WITH 0# APPLIED

Database File: pg&e-piacetine2-27_rcbl.db
Dataset Pathname: pass4
Presentation Format: ddcblrad8
Dataset Creation: Mon May 06 08:47:38 2013 by Log Halliburton Casedho
Charted by: Depth in Feet scaled 1:240

LTEN	CCL	BONDIX	Sector Maximum	MSG	SECTORS
0 (lb5000	72 -8	0 1	100	200 1200	1 8
	TT3FT	0 AMP3FT (mV) 100	0		
	412 (usec) 312	0 AAMP (mV) 20	0 Sector Average100		
	0 GR (GAPI) 150		Sector Minimum		
	0 CNSSC (cps) 600		0 100		

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200
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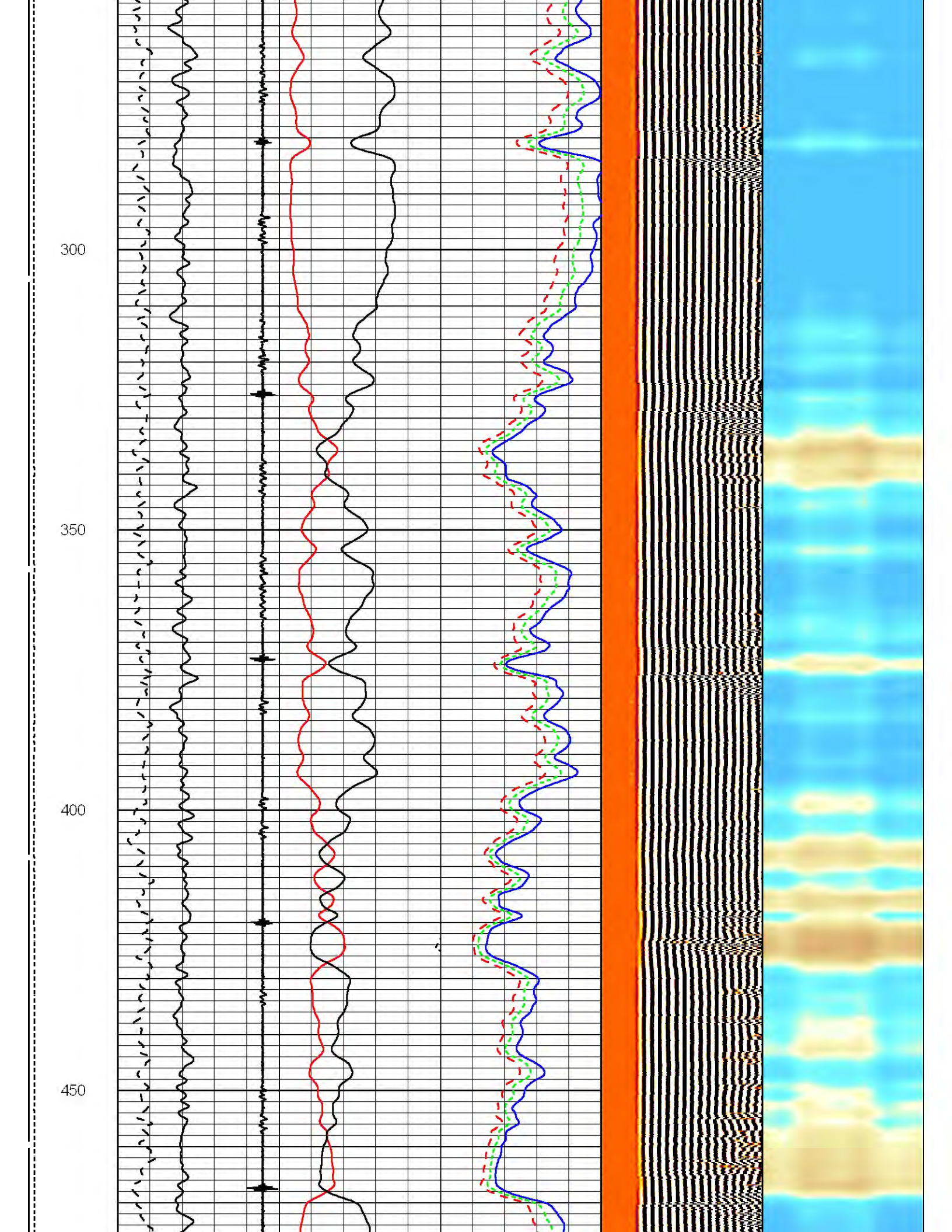
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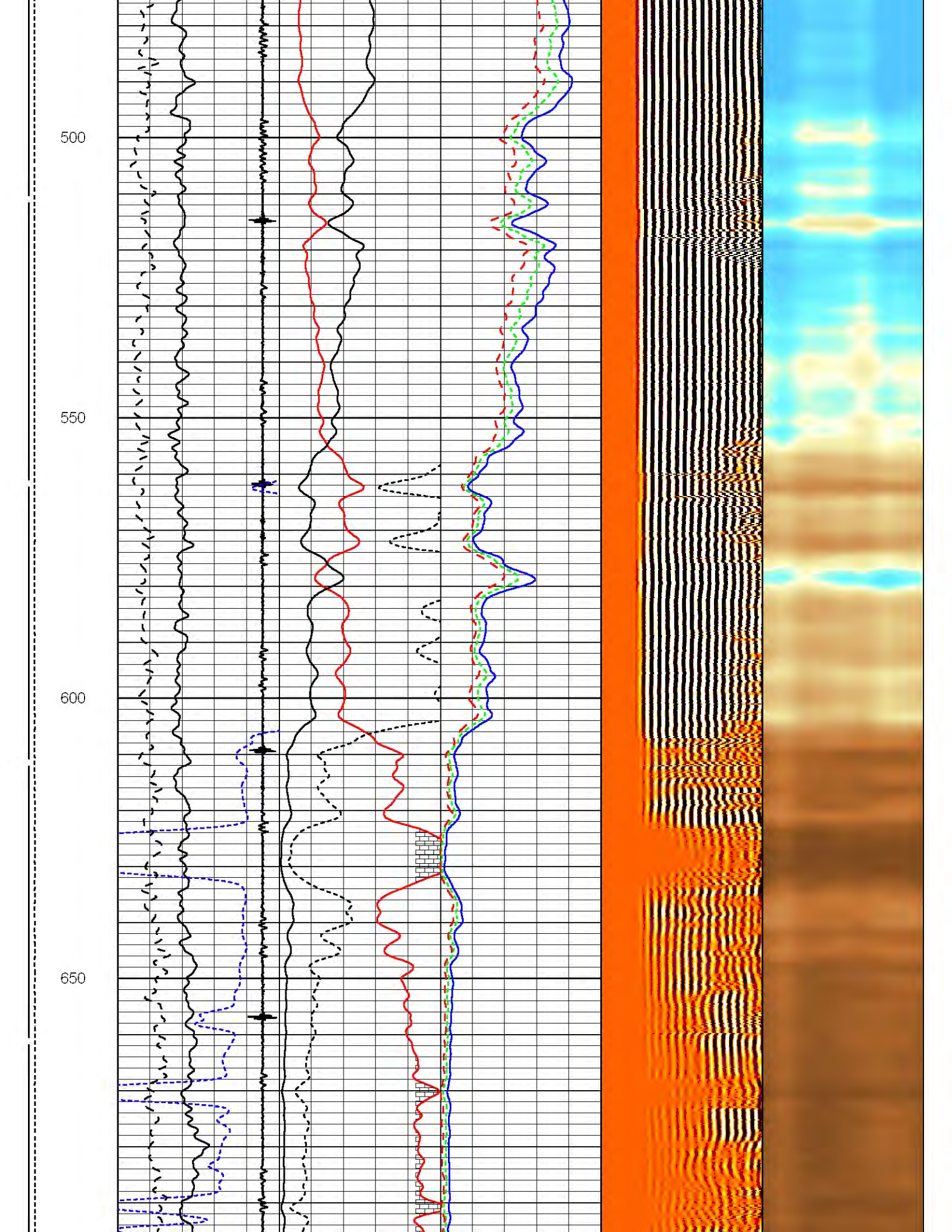
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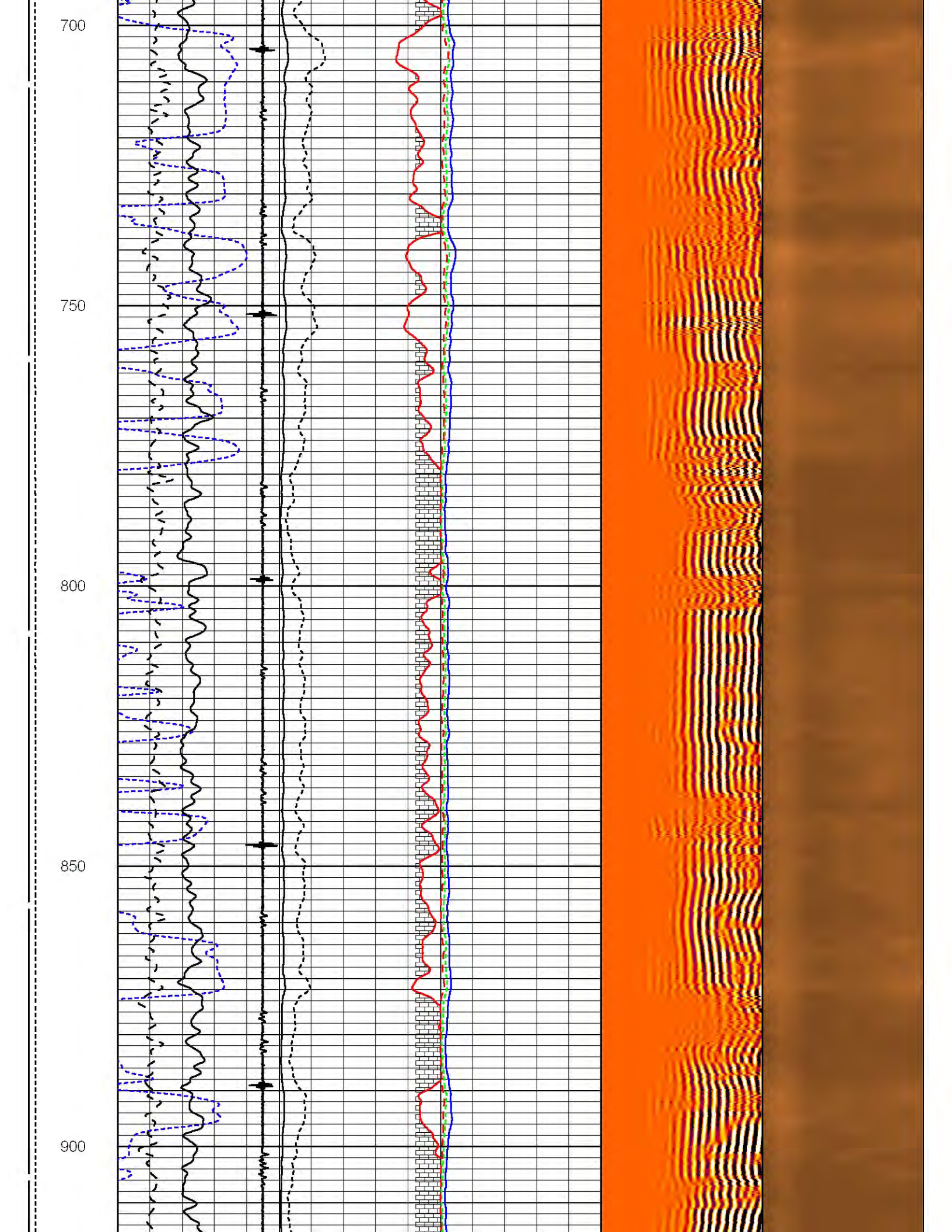
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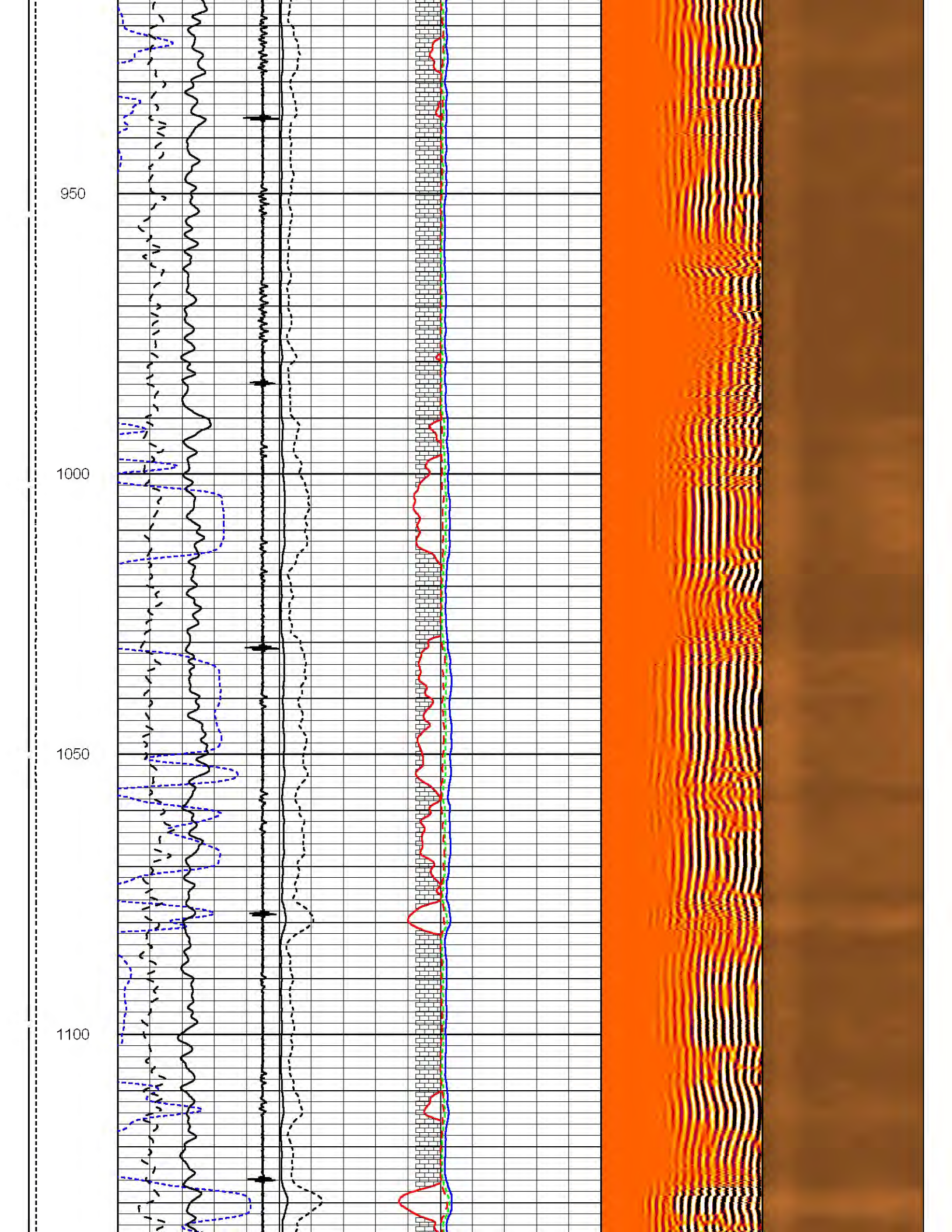
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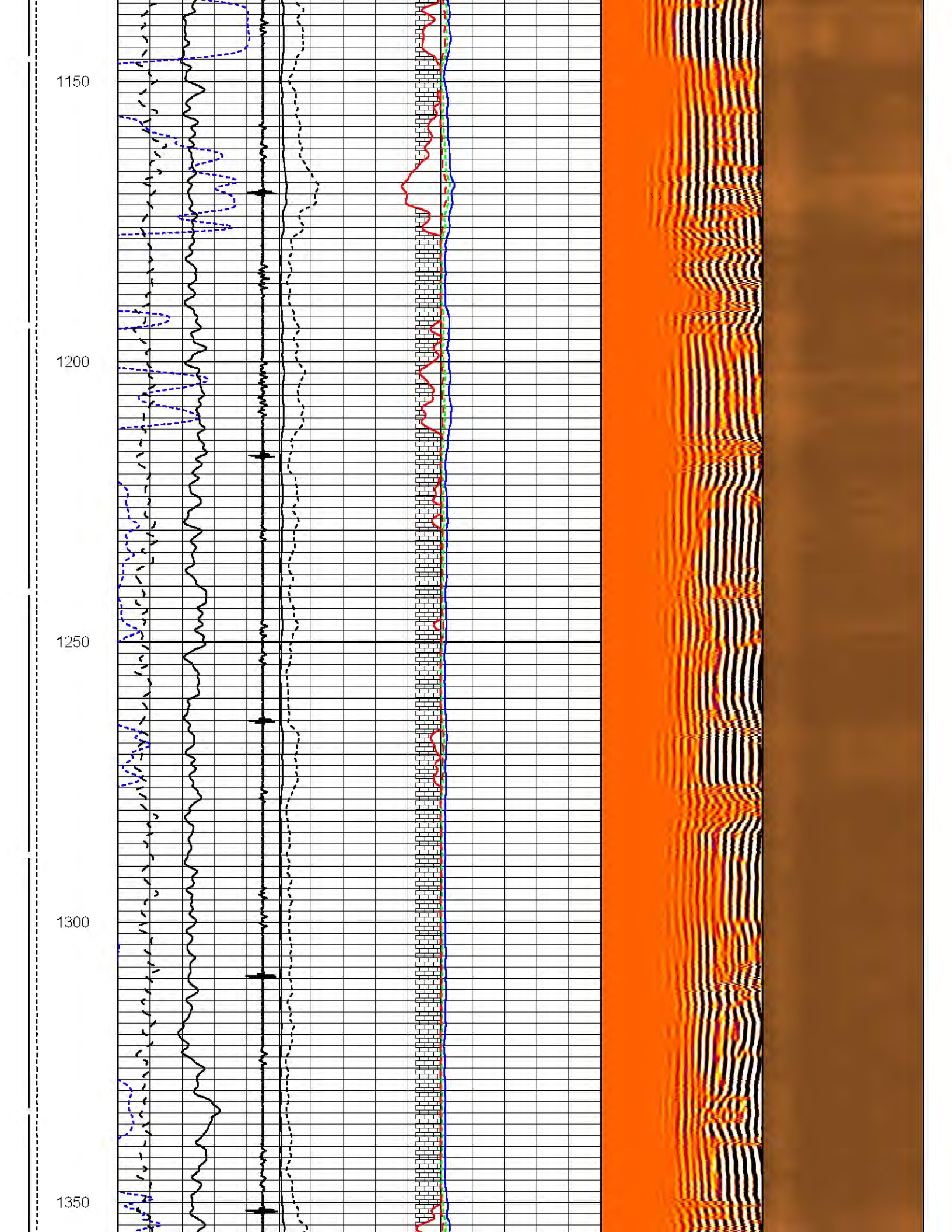
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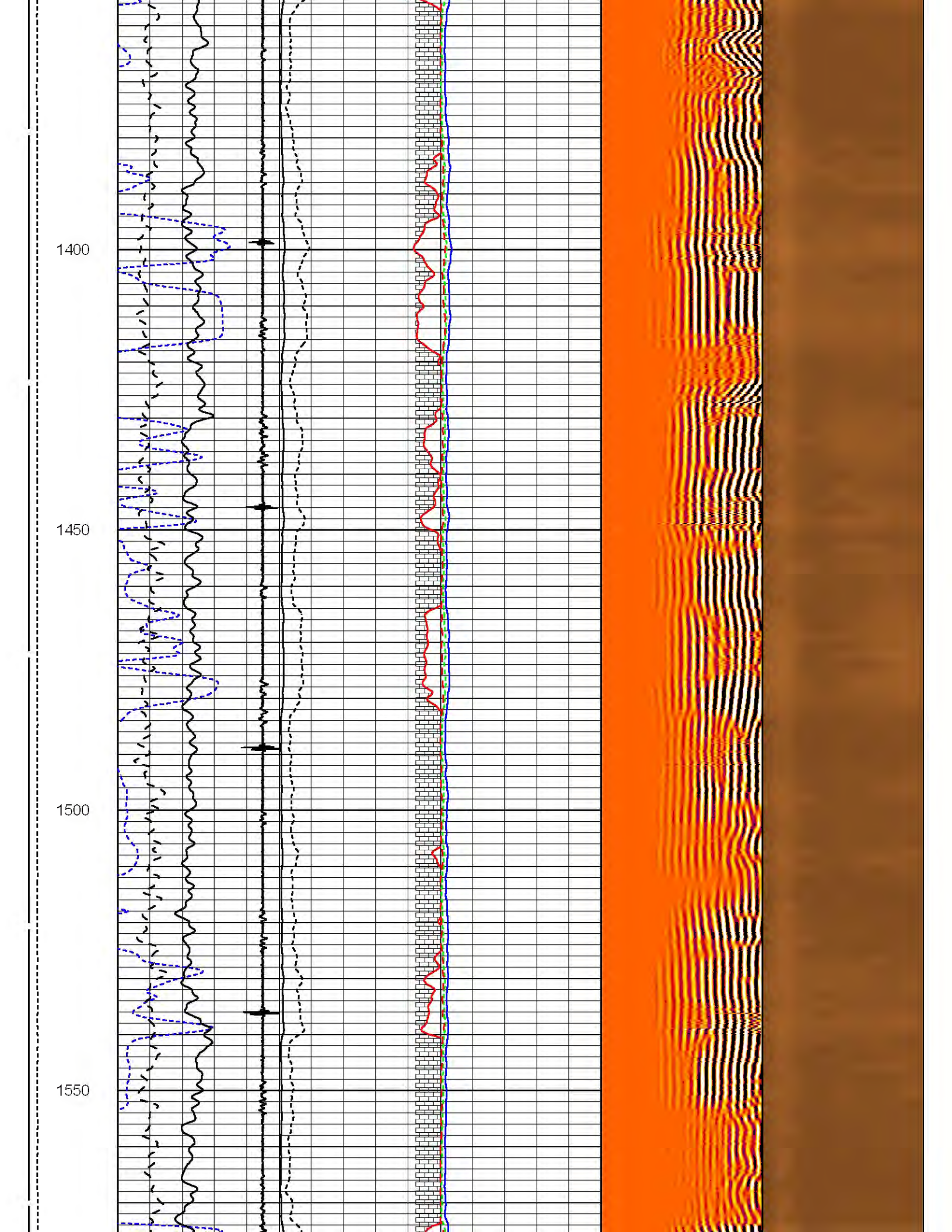
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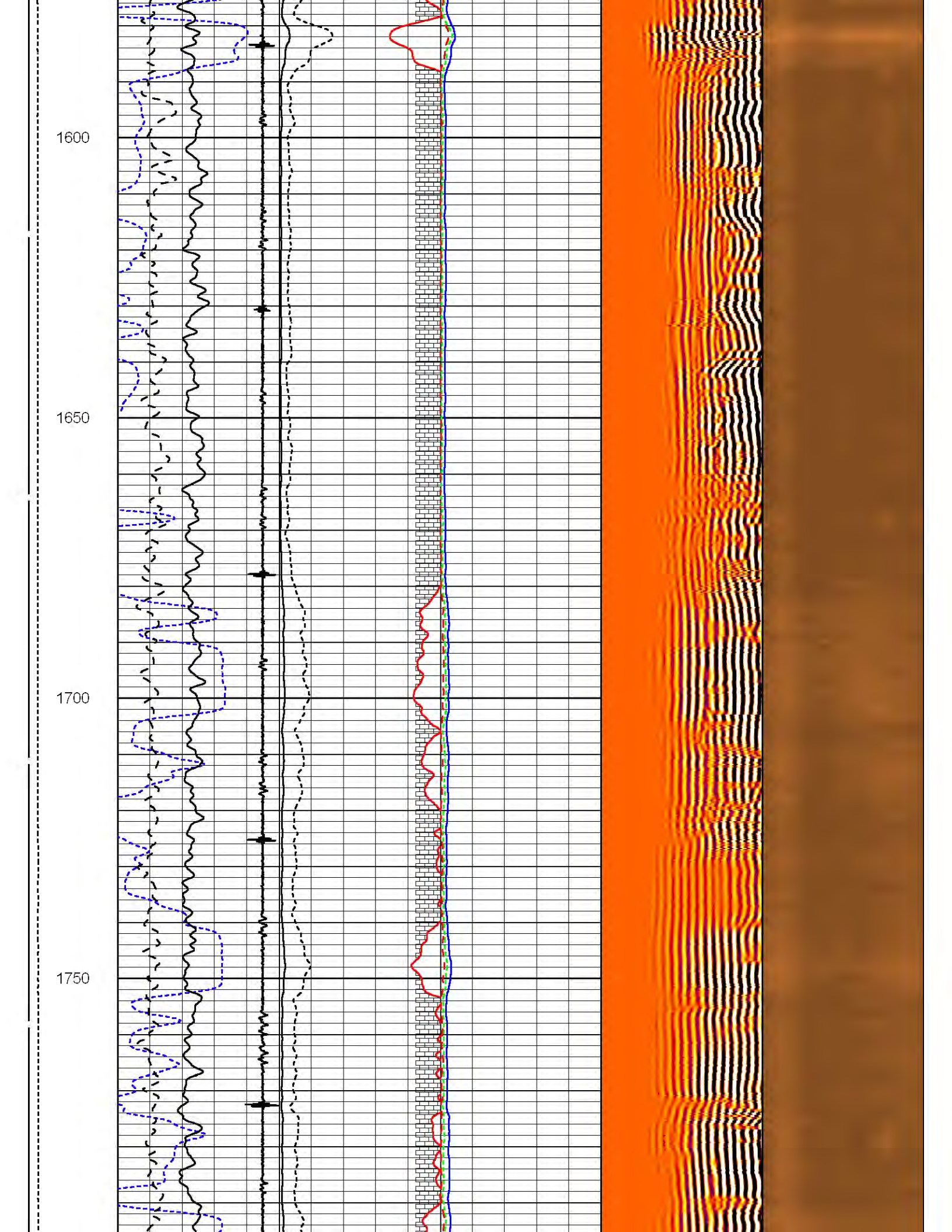
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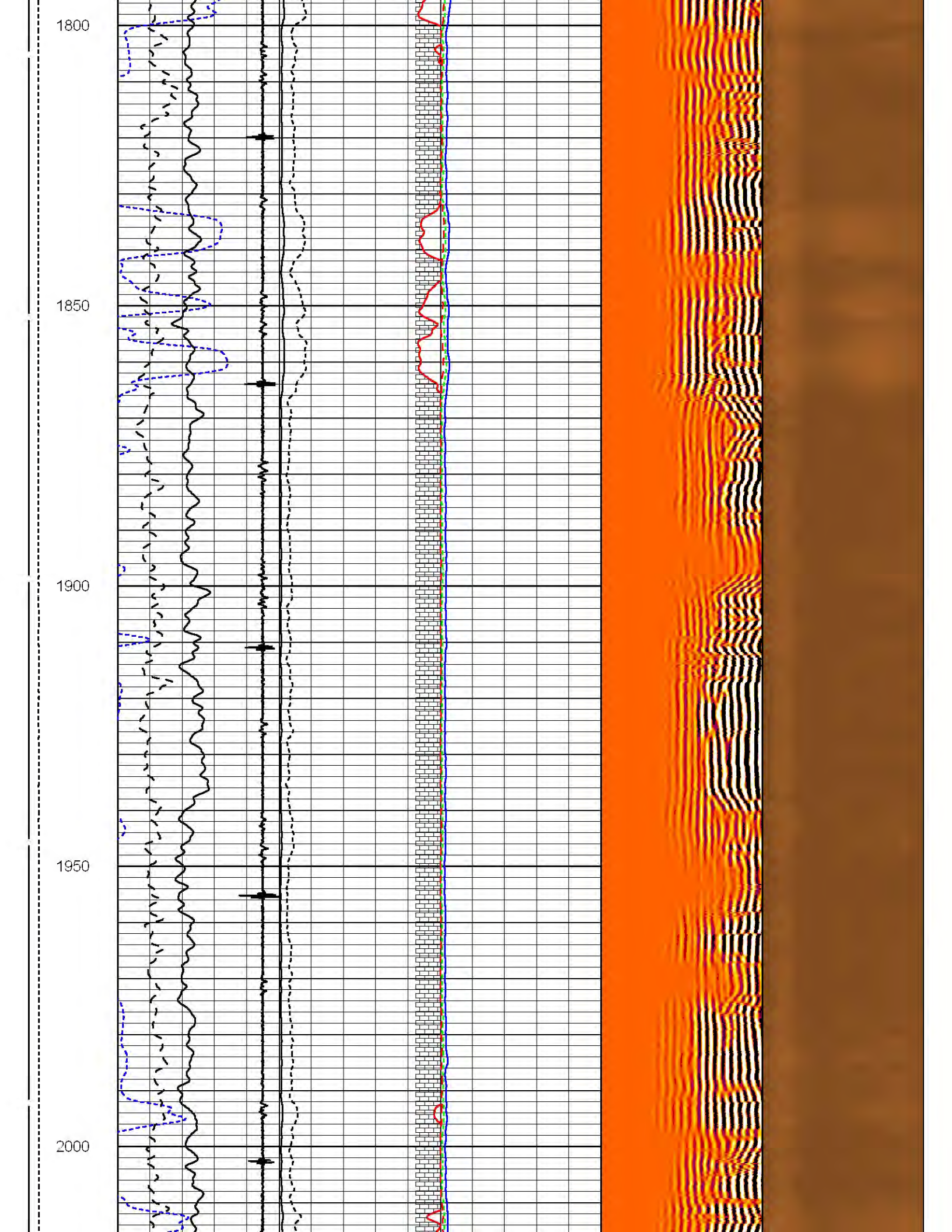
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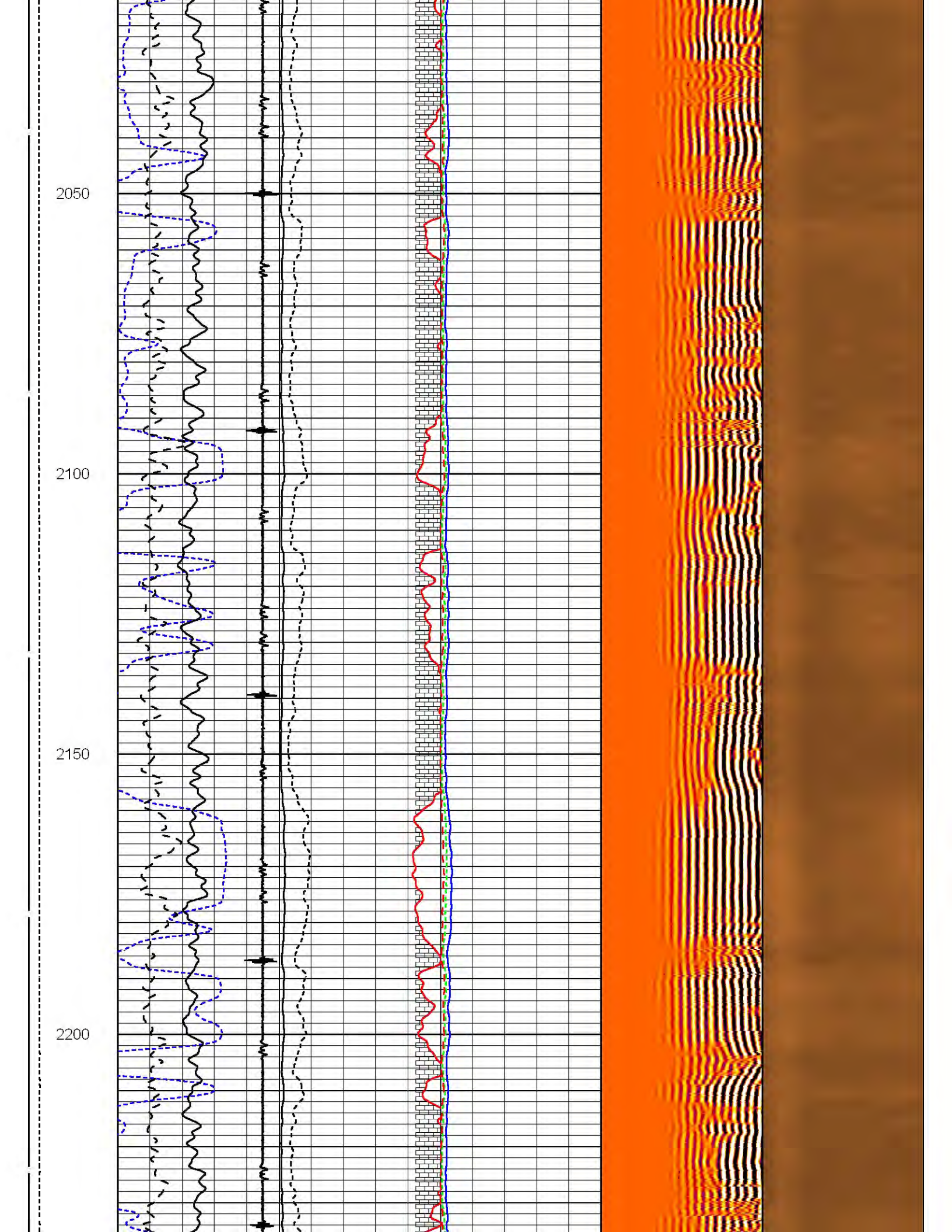
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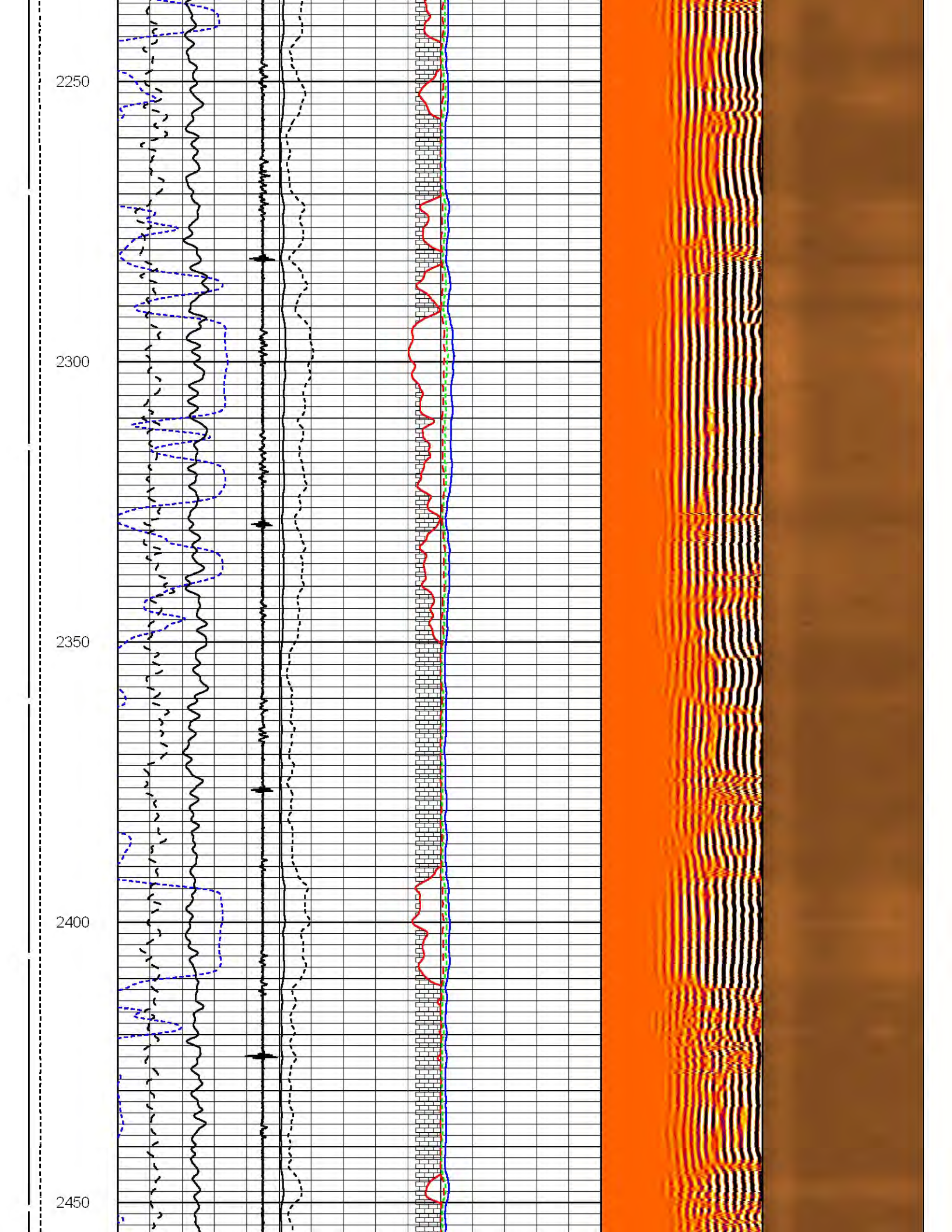
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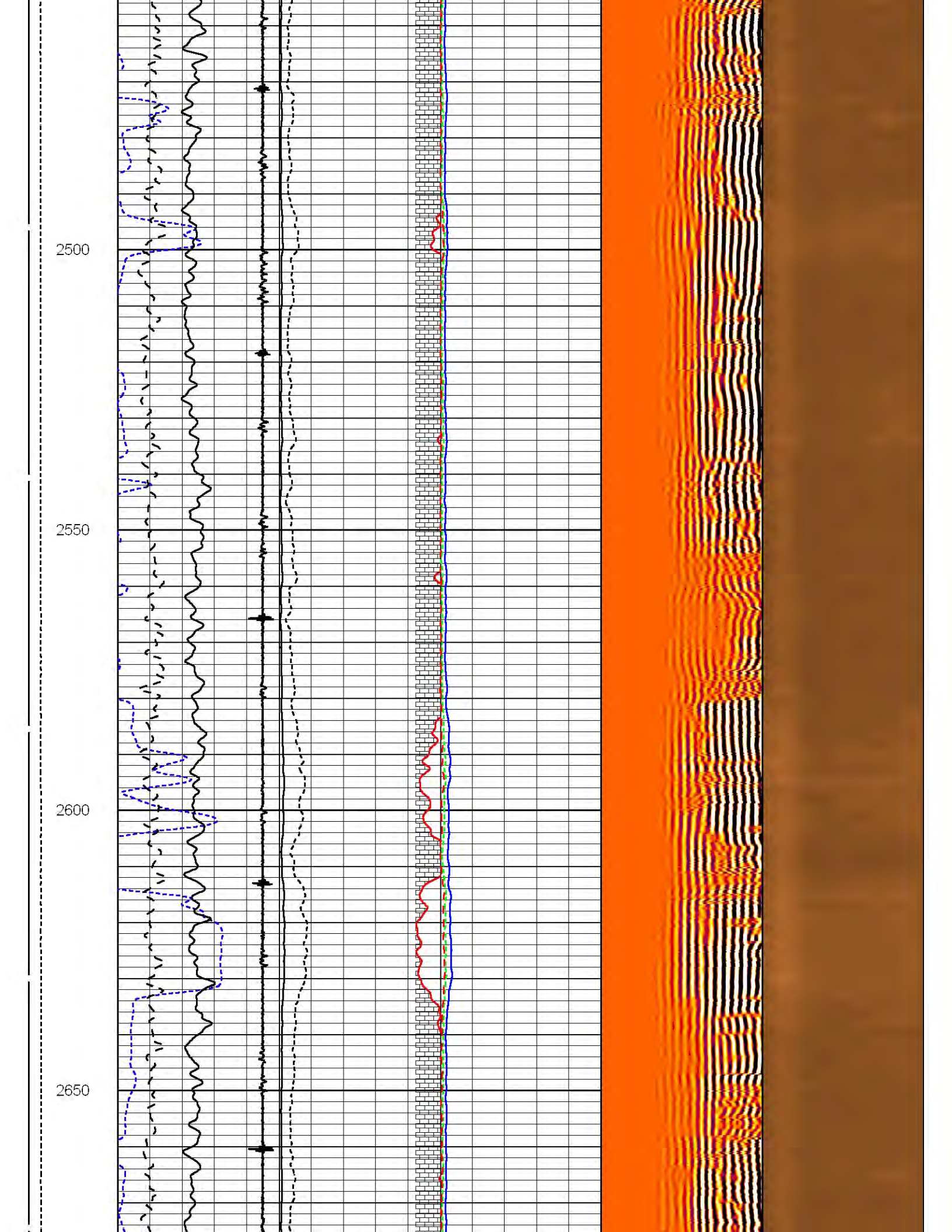
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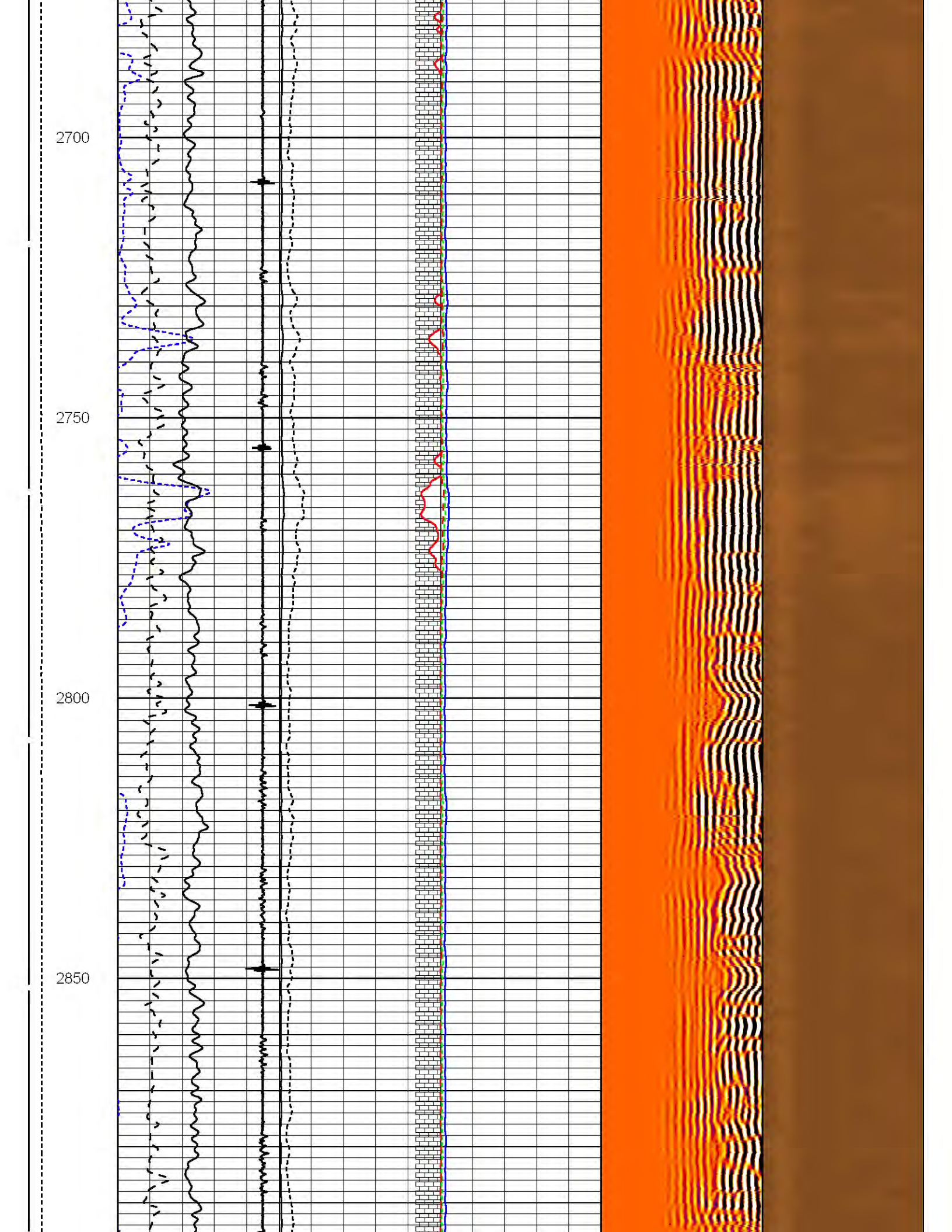
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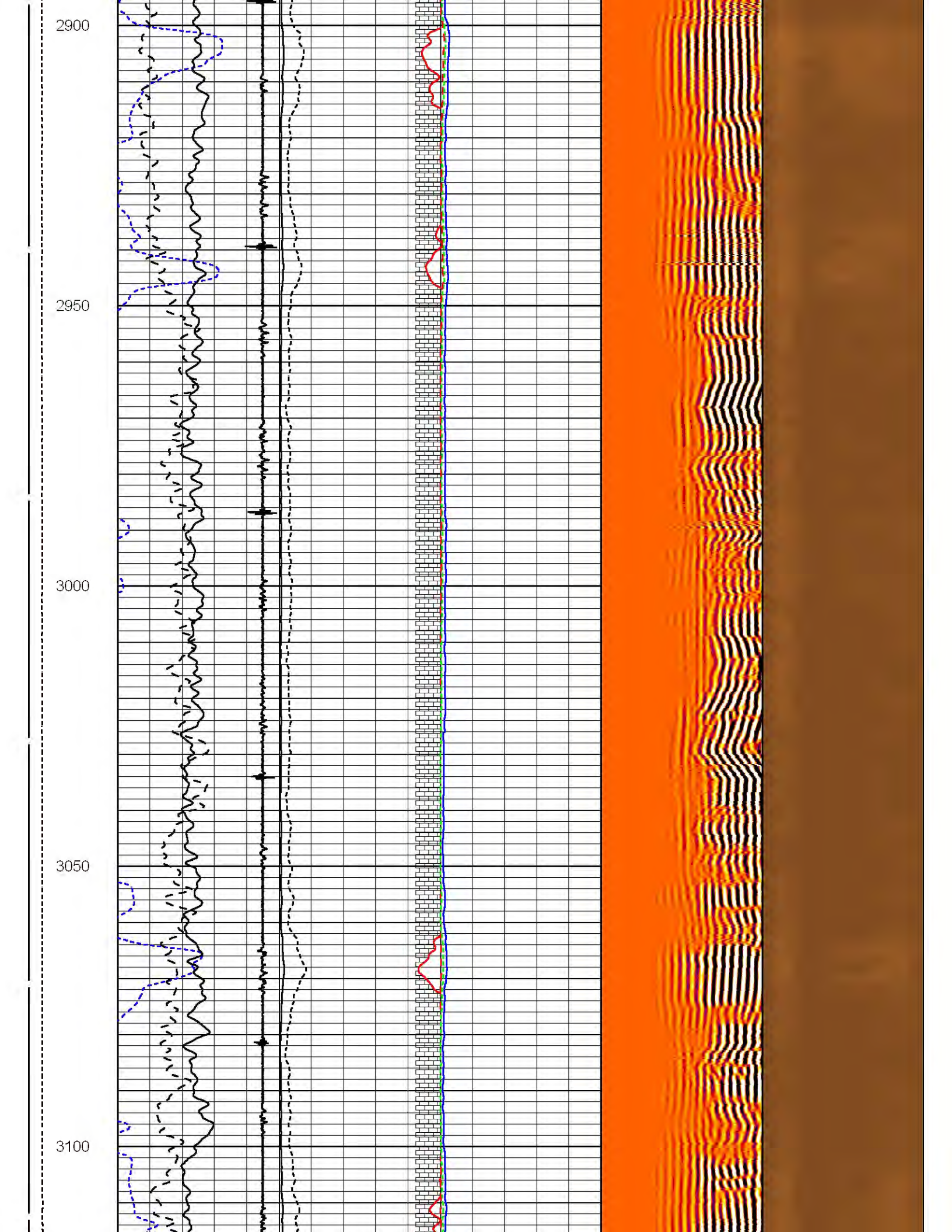
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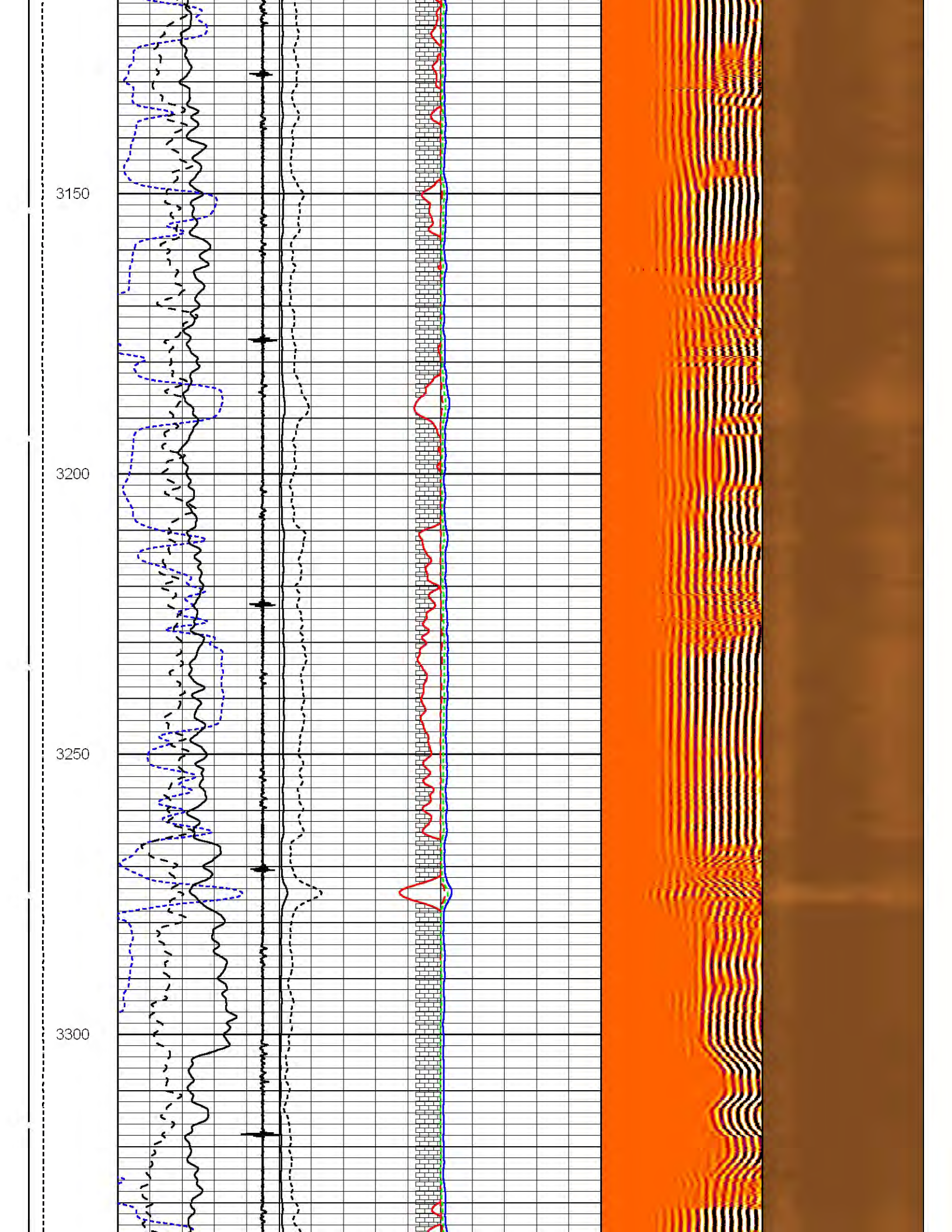
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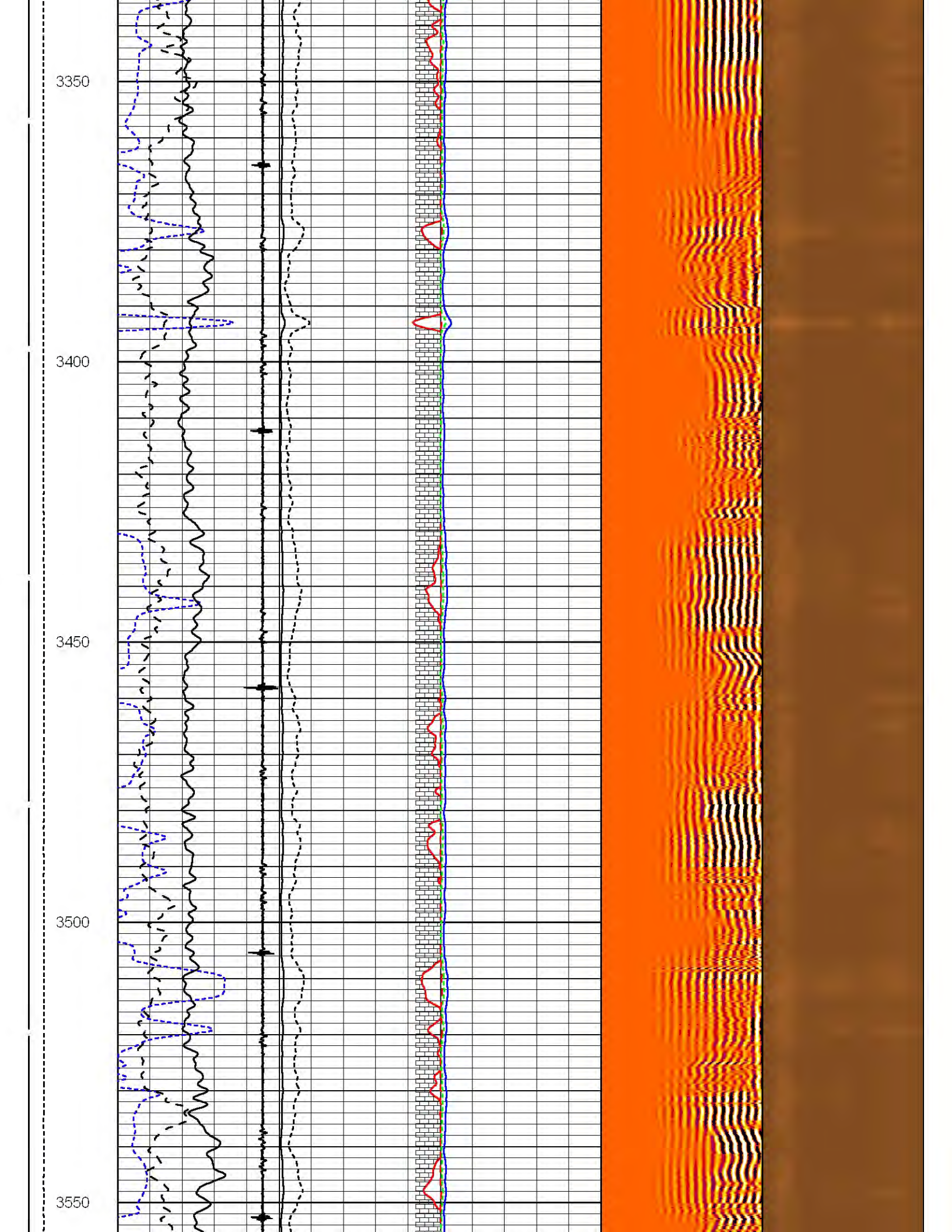
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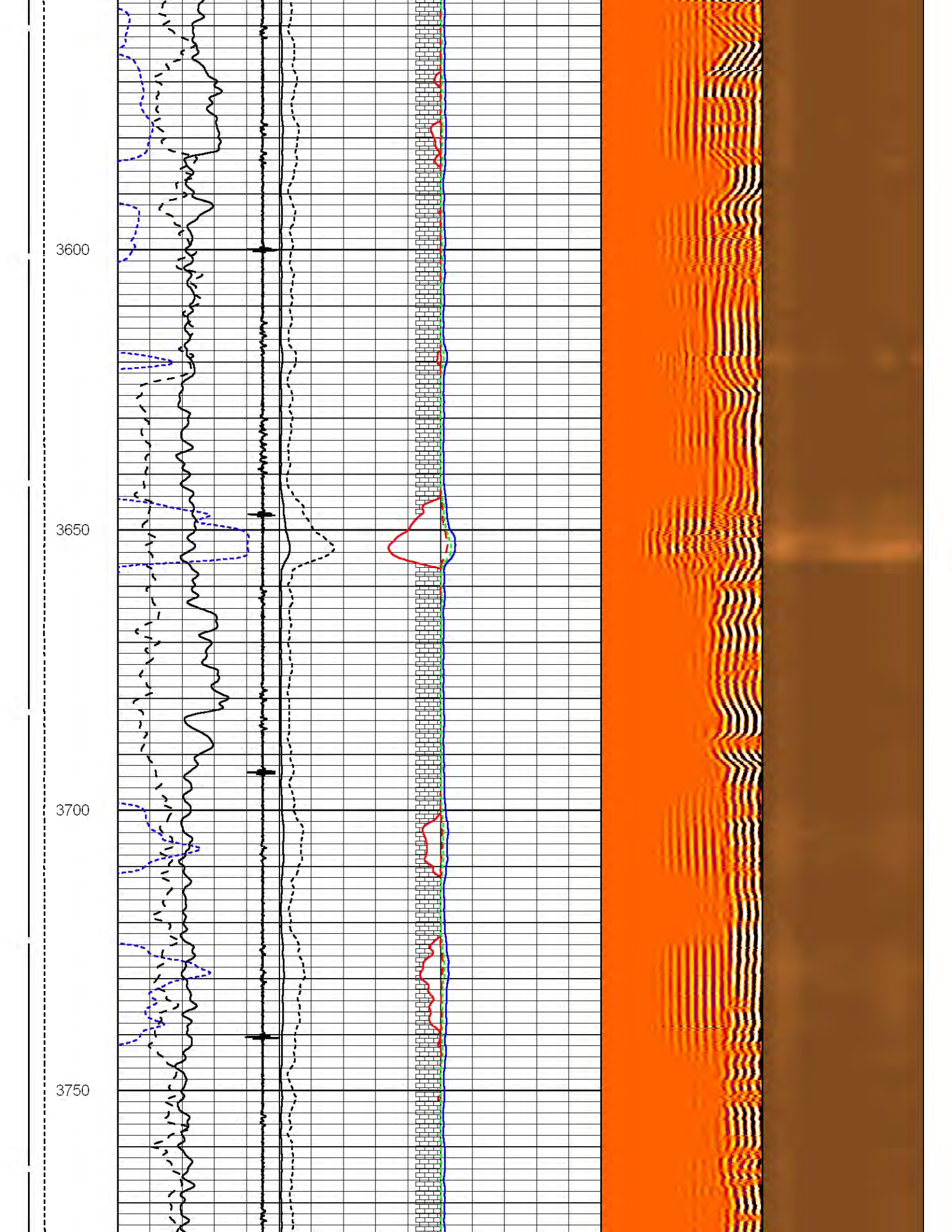
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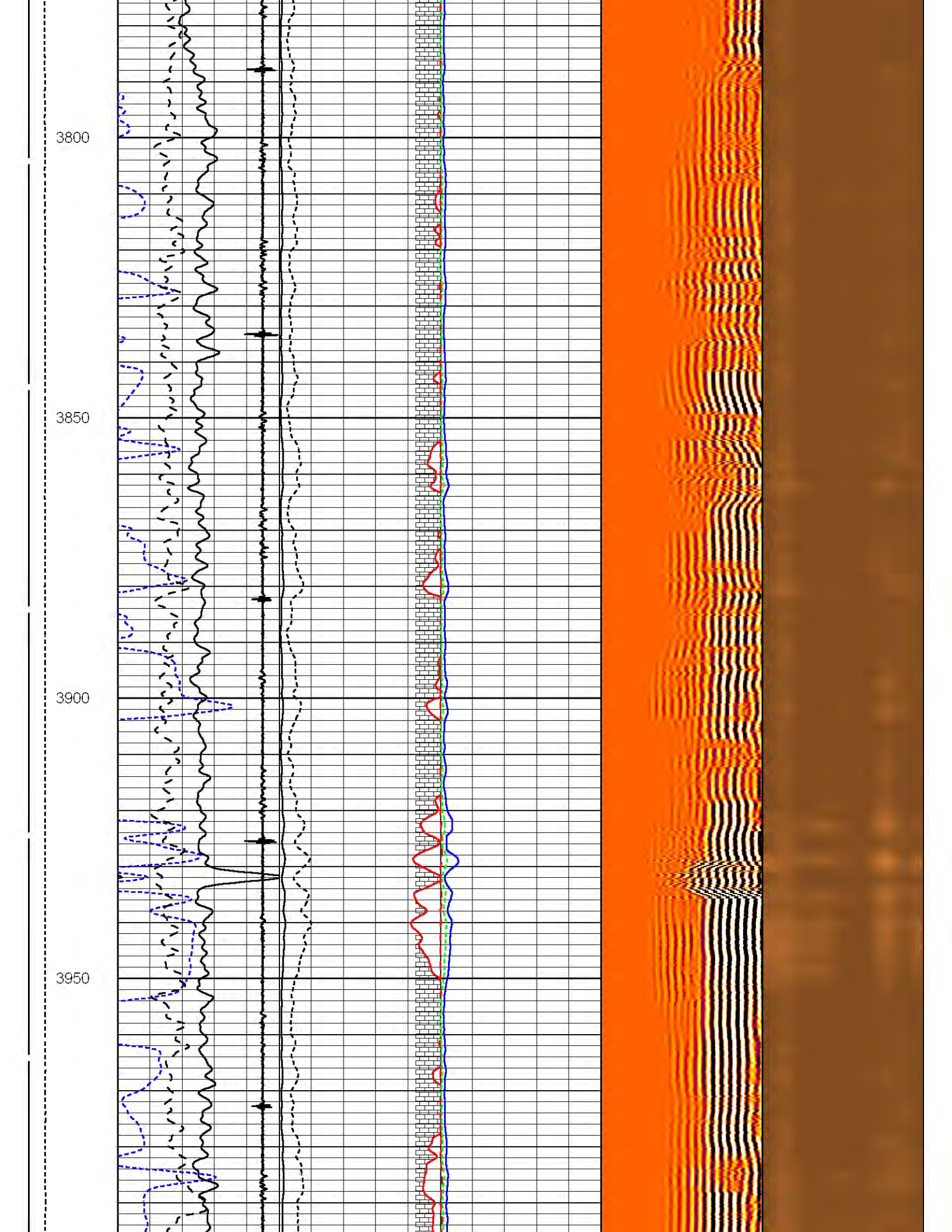
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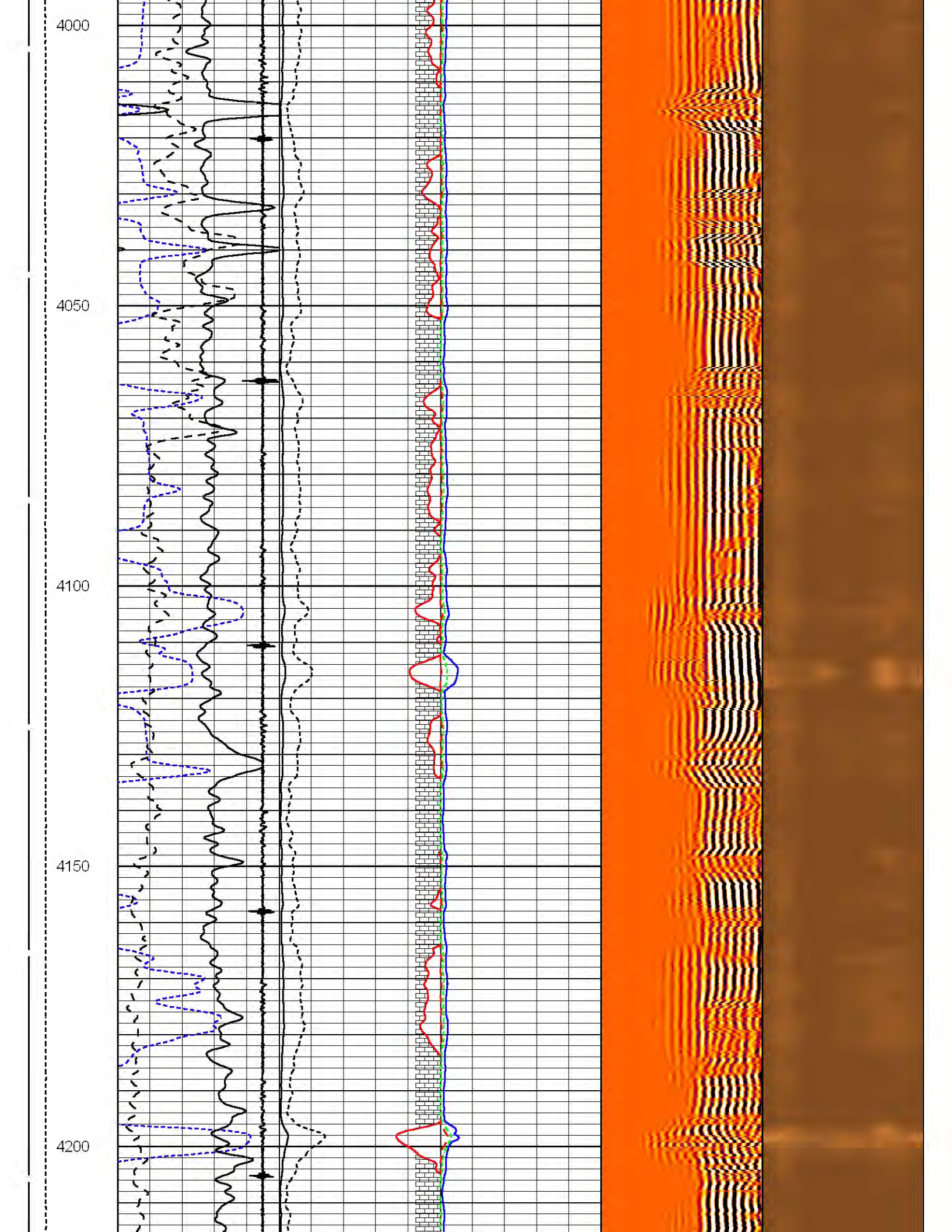
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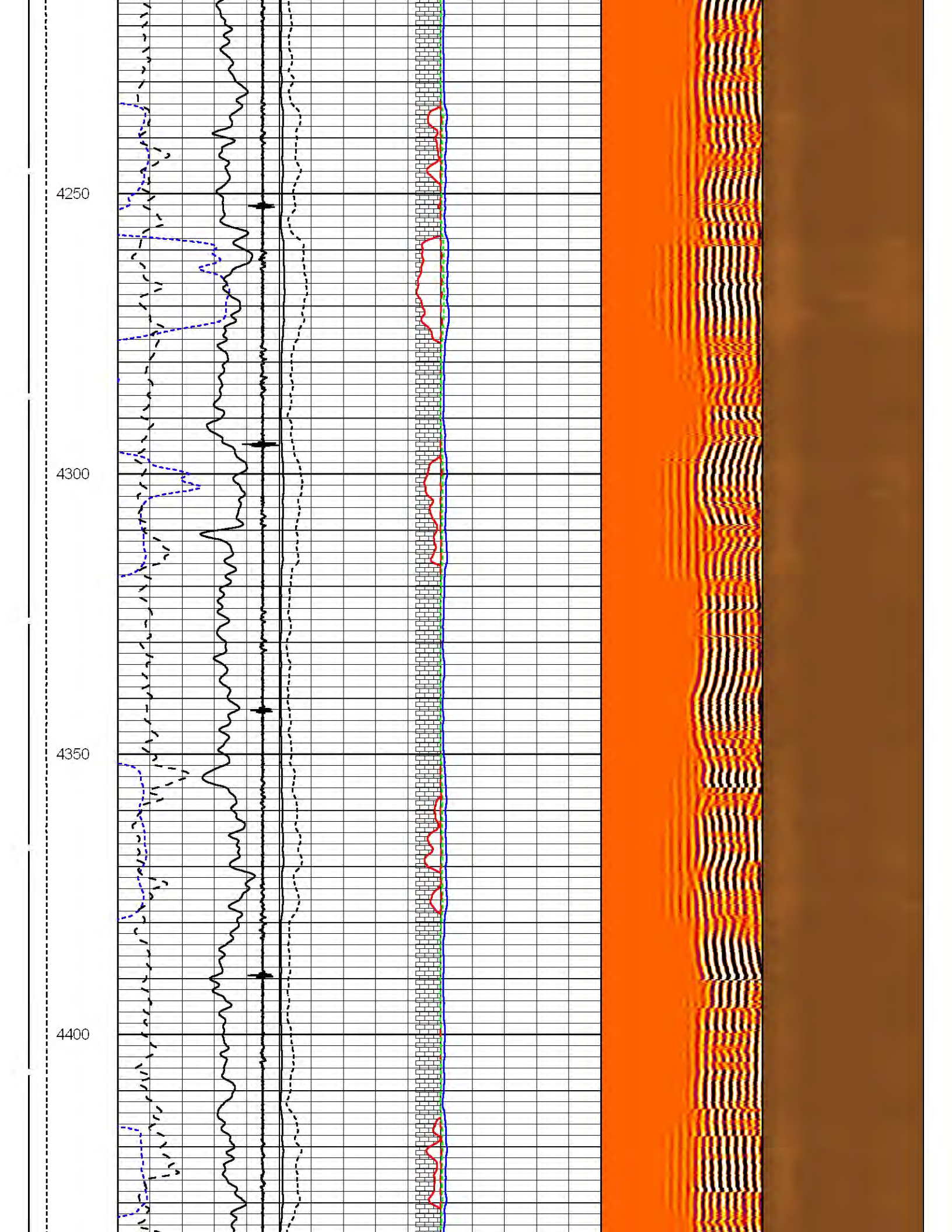
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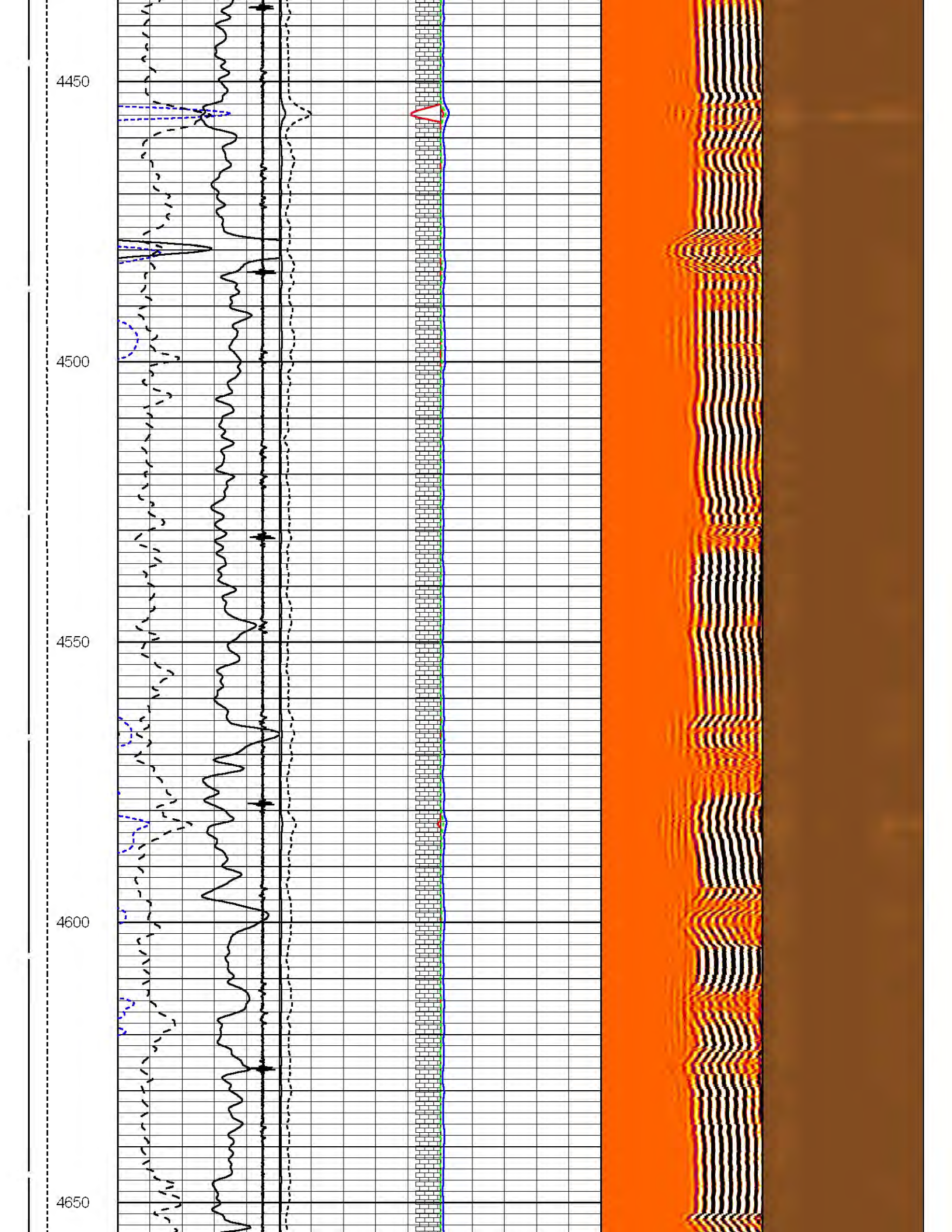
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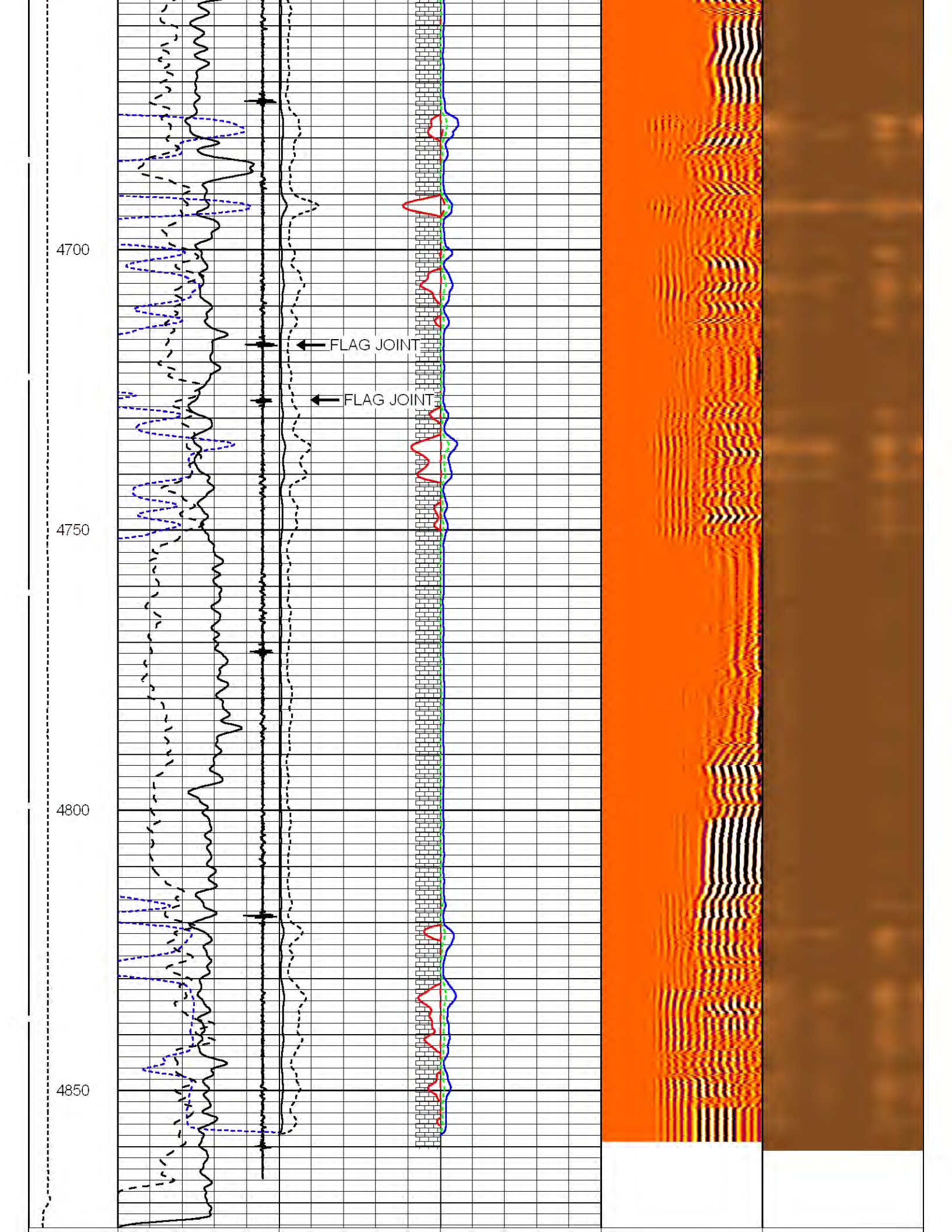
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FLAG JOINT
FLAG JOINT
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4800
4850

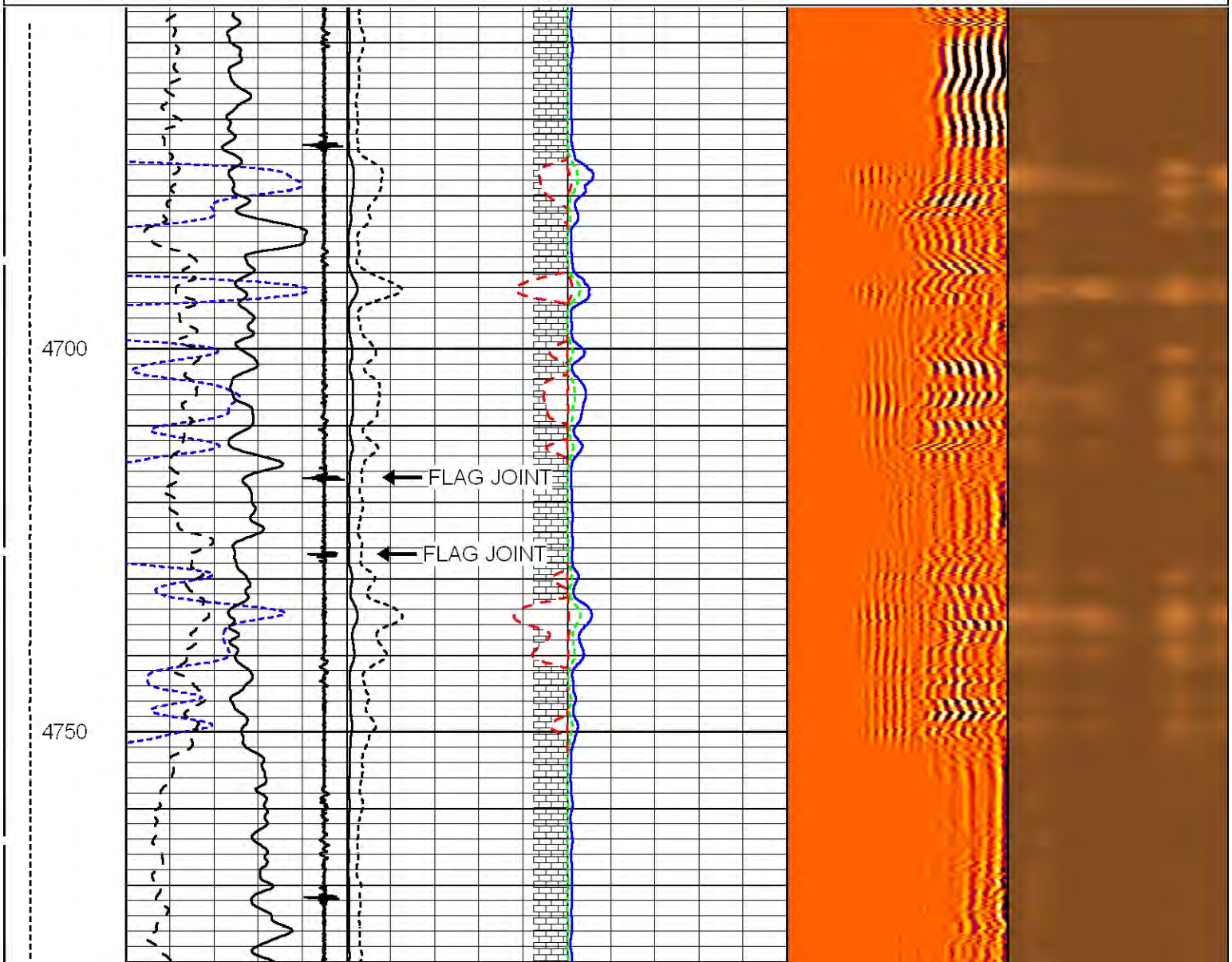
LTEN	72 CCL -8	0 BONDIX 1	Sector Maximum	200 MSG 1200	1 SECTORS 8
0 (lb5000	TT3FT	0 AMP3FT (mV) 100	0 100		
	412 (usec) 312	0 AAMP (mV) 20	0 Sector Average100		
	0 GR (GAPI) 150		Sector Minimum		
	0 CNSSC (cps) 600		0 100		

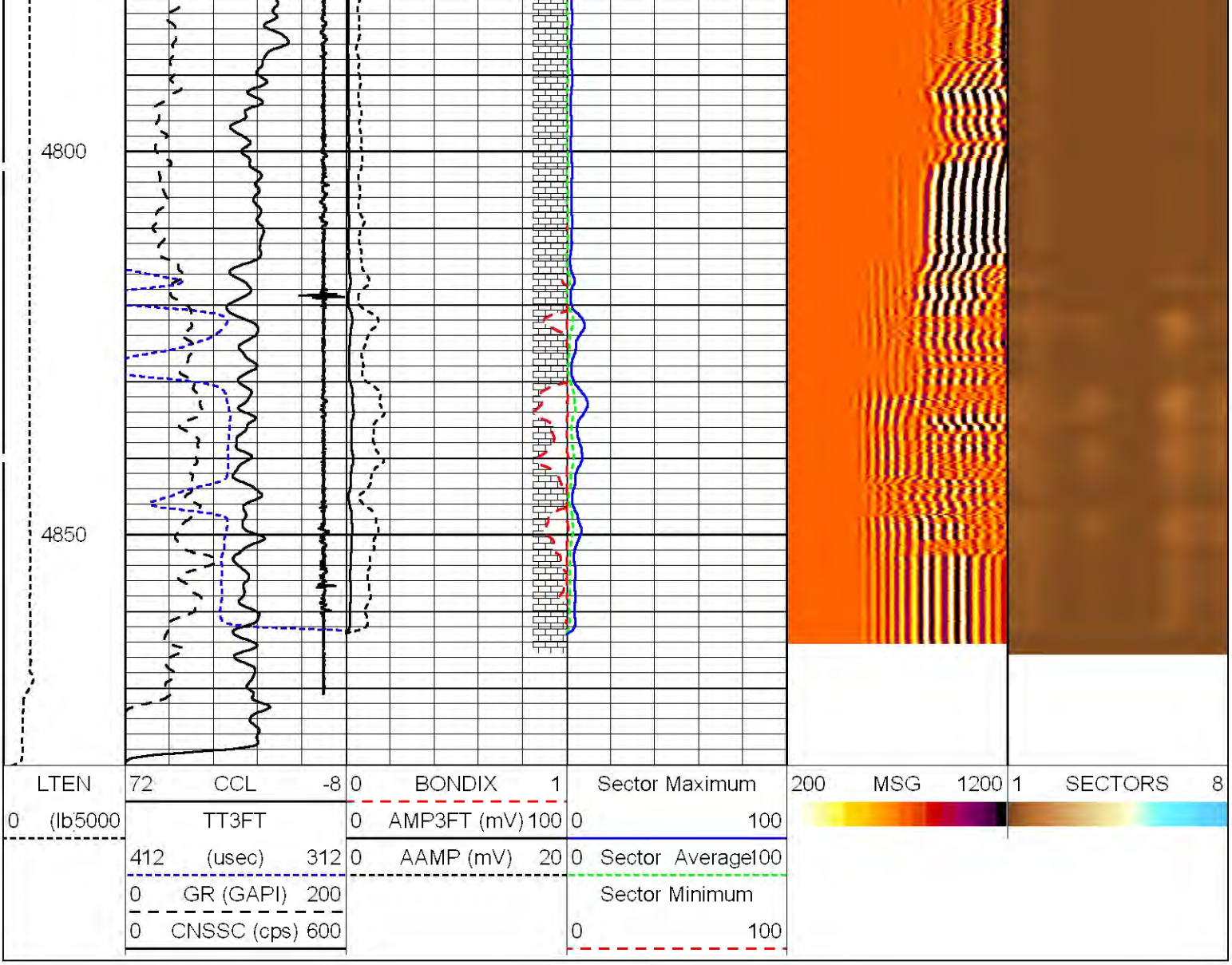
HALLIBURTON

REPEAT PASS LOGGED WITH 0# APPLIED

Database File: pg&e-piacetine2-27_rcbl.db
Dataset Pathname: pass3
Presentation Format: ddcblrad8
Dataset Creation: Mon May 06 08:39:42 2013 by Log Halliburton Casedho
Charted by: Depth in Feet scaled 1:240

LTEN	72 CCL -8	0 BONDIX 1	Sector Maximum	200 MSG 1200	1 SECTORS 8
0 (lb5000	TT3FT	0 AMP3FT (mV) 100	0 100		
	412 (usec) 312	0 AAMP (mV) 20	0 Sector Average100		
	0 GR (GAPI) 200		Sector Minimum		
	0 CNSSC (cps) 600		0 100		





Log Variables

Database:D:\Warrior_data\pg&e-piacetine2-27_rcbl.db
Dataset: field/well/run1/pass4

Top - Bottom

CMTTKCOR	CSTKCOR	SZCOR	CASED?	LTH	CMNTTHCK in	CASETHCK in	PPT usec
Off	Off	Off	Yes	Sandstone	0	0	0

CASEWGHT lb/ft	MAXAMPL mV	MINAMPL mV	MINATTN db/ft	CASEOD in	PERFS	TDEPTH ft	BOTTEMP degF
15.5	72	2	0.8	5.5	0	0	150

BITSIZE in
8.5

Calibration Report

Database File: pg&e-piacetine2-27_rcbl.db
Dataset Pathname: pass4
Dataset Creation: Mon May 06 08:47:38 2013 by Log Halliburton Casedho

Compensated Neutron Calibration Report

Serial Number: 11817834
Tool Model: 275Dig

CALIBRATION

Detector	Readings		Target		Normalization
Short Space	1.00	cps	1.00	cps	1.0000
Long Space	1.00	cps	1.00	cps	1.0000

PRE-SURVEY VERIFICATION

	Detector	Readings		Measured		Target	
1)	Short Space		cps				
	Long Space		cps		pu		pu
2)	Short Space		cps				
	Long Space		cps		pu		
3)	Short Space		cps				
	Long Space		cps		pu		

POST-SURVEY VERIFICATION

	Detector	Readings		Measured		Target	
1)	Short Space		cps				
	Long Space		cps		pu		pu
2)	Short Space		cps				
	Long Space		cps		pu		pu
3)	Short Space		cps				
	Long Space		cps		pu		pu

Gamma Ray Calibration Report

Type / Serial: probe275dig / 11817834

SHOP CALIBRATION Fri Mar 08 14:34:27 2013

	Counts/Sec.	Gain	Offset	Jig	Units
Background	0.0				cps
Calibrator	1.0				cps
		0.8558			GAPI/cps

PRIMARY VERIFICATION

Background	0.0				cps
Calibrator	0.0				cps
Difference				0.0	GAPI

BEFORE SURVEY VERIFICATION

Background	0.0				cps
Calibrator	0.0				cps
Difference				0.0	GAPI

AFTER SURVEY VERIFICATION

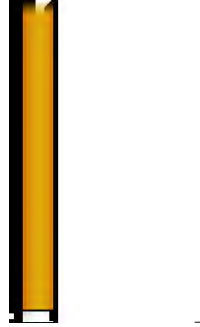
Background	0.0				cps
Calibrator	0.0				cps
Difference				0.0	GAPI

CBL Calibration Report

Serial Number: 11923960
Tool Model: Probe

Performed:	Mon May 06 08:24:25 2013	
Depth:	300.063	ft
Casing Diameter:	5.500	in
	3' Spacing	
Signal Zero:	0.000	mV
Calibrated Amplitude:	71.921	mV
Reading at Signal Zero:	0.018	V
Reading in Free Pipe:	0.155	V
Gain:	274.459	
Offset:	-3.469	

Sensor	Offset (ft)	Schematic	Description	Len (ft)	OD (in)	Wt (lb)
			STND_CH 1.4375 IN CABLE HEAD	1.50	1.44	2.00
			Probe_275 Probe 2 3/4 Centralizer	2.79	2.75	20.00
WVF3FT	16.97		RBT_PRB275-Probe (11923960) Probe Radii Bond Tool with Digital Telemetry	8.33	2.75	90.00
WVFCAL	16.97					
WVFS1	16.97					
WVFS2	16.97					
WVFS3	16.97					
WVFS4	16.97					
WVFS5	16.97					
WVFS6	16.97					
WVFS7	16.97					
WVFS8	16.97					
WVF5FT	15.97					
			Probe_275 Probe 2 3/4 Centralizer	2.79	2.75	20.00
CCL	9.15					
GR	7.78		GR_PRB275-probe275dig (11817834) Probe Digital Gamma CCL	4.75	2.75	57.00

			CNT_PRB275-275Dig (11817834) Probe Digital CNL	5.24	2.75	40.00
CNLSC	1.91					
CNSSC	1.48					
LLMTEN	0.00					
UTCTIM	0.00					

Dataset: pg&e-piacetine2-27_rcbl.db: field/well/run1/pass4
Total Length: 25.40 ft
Total Weight: 229.00 lb
O.D. 2.75 in

Company PG&E
Well PIACETINE 2-27
Field KING ISLAND GAS
County SAN JOAQUIN State CALIF.

HALLIBURTON

GAMMA RAY NEUTRON
RADIAL CEMENT
BOND LOG

HALLIBURTON

ARRAY COMPENSATED TRUE RESISTIVITY SPECTRAL DENSITY DUAL SPACED NEUTRON 2"=100' & 5"=100'

COMPANY PG&E
WELL PIACENTINE 2-27
FIELD/BLOCK KING ISLANDS GAS
COUNTY SAN JOAQUIN
STATE CA

API No. 04-077-20736
Location LAT: 38.08155572
LONG:121.422162329

Sect. 27 Twp. 3N Rge. 5E

Other Services:
RWCH
BSAT
ICT
CSNG
MRIL
XRMI
RDT / SWC

Permanent Datum	GL	Elev. -4.5 ft	Elev.: K.B. 7.5 ft
Log measured from	KB	, 12.0 ft above perm. Datum	D.F. 0.0 ft
Drilling measured from	KB		G.L. -4.5 ft

Date		24-Mar-13					
Run No.		1					
Depth - Driller		4970.00 ft					
Depth - Logger		4972.0 ft					
Bottom - Logged Interval		4960.0 ft					
Top - Logged Interval		613.0 ft					
Casing - Driller		9.625 in	@ 613.0 ft	@		@	
Casing - Logger		613.0 ft					
Bit Size		8.500 in		@		@	
Type Fluid in Hole		LSND					
Density	Viscosity	10.2 ppg	38.00 s/qt				
PH	Fluid Loss	8.00 pH	3.9 cptm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		3.400 ohmm	@ 72.00 degF	@		@	
Rmf @ Meas. Temperature		2.71 ohmm	@ 69.00 degF	@		@	
Rmc @ Meas. Temperature		4.620 ohmm	@ 69.00 degF	@		@	
Source Rmf	Rmc	MEAS	MEAS				
Rm @ BHT		2.06 ohmm	@ 123.0 degF	@		@	
Time Since Circulation		6.1 hr					
Time on Bottom		24-Mar-13 23:06					
Max. Rec. Temperature		123.0 degF	@ N/A	@		@	
Equipment	Location	11871069	BKSFLD				
Recorded By		D. SANDOVAL					
Witnessed By		FRANK B. CRESSY					

Fold here

Service Ticket No.: 900310522 API Serial No.: 04-077-20736 PGM Version: WL INSITE R3.8.4 (Build 5)

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE

| | | | | | | |

GENERAL				GAMMA		ACOUSTIC			DENSITY			NEUTRON		
Run	Depth		Speed	Scale		Scale		Matrix	Scale		Matrix	Scale		Matrix
No.	From	To	ft/min	L	R	L	R		L	R		L	R	
ONE	4972'	613'	REC	0	150	175	75	SAND	1.65	2.65	2.65	60	0	SAND

DIRECTIONAL INFORMATION

Maximum Deviation	@	KOP	@

Remarks:

ACRT/BSAT/ICT/SDL/DSN/CSNG/GR/RWCH RUN IN COMBINATION

SDL VOLUMES (ft^3) CALCULATED FOR A 5.5" CASING FROM TD TO SHOE: AHVT: 1043 BHVT: 1764

ICT VOLUMES (ft^3) CALCULATED FOR A 5.5" CASING FROM TD TO SHOE: AHVT: 1097 BHVT: 1818

DSNT CLASS POROSITY PARAMETER ENABLED.

CREW: F. VARGAS, B. CONTRERAS, A. VAZQUEZ RIG: PG 4

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

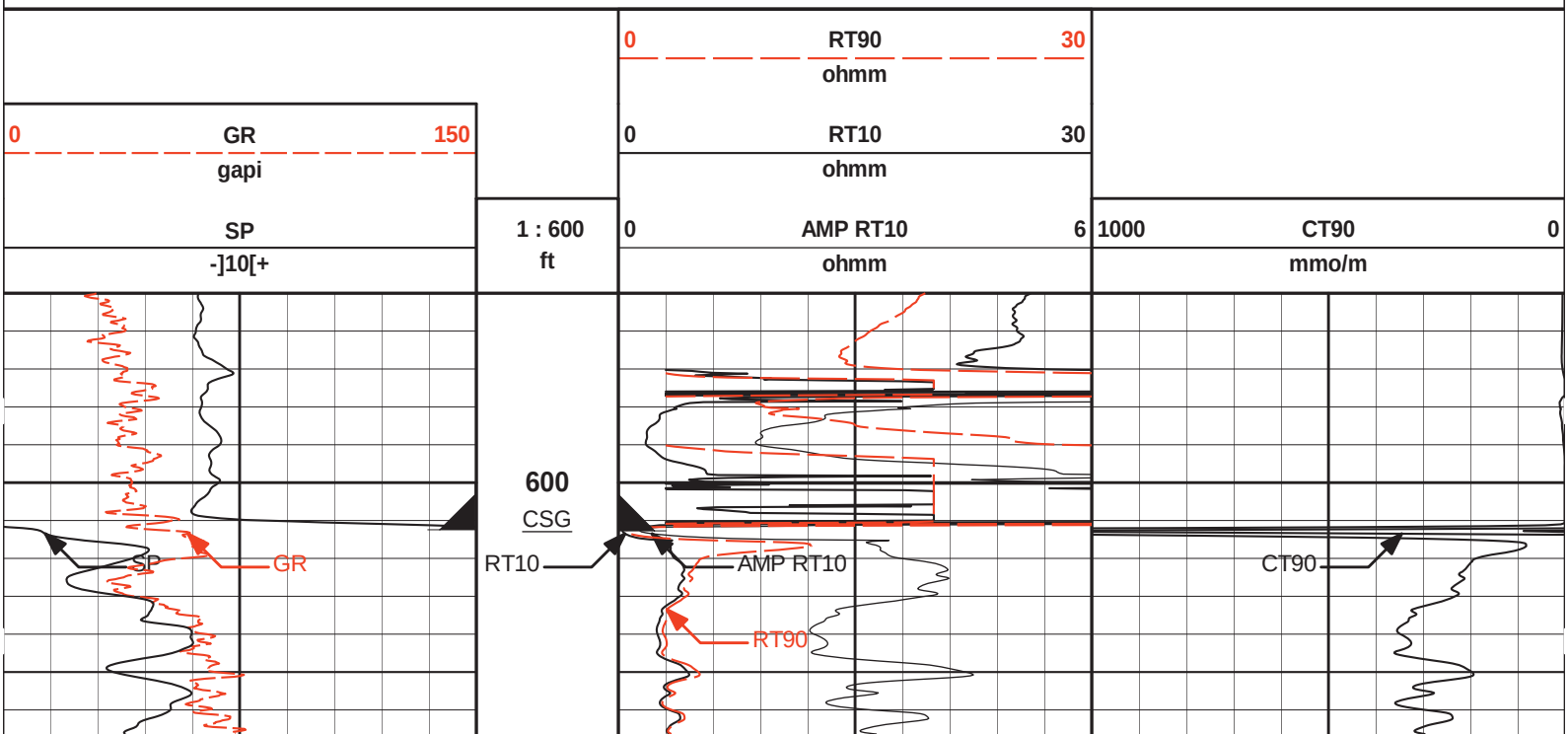
HALLIBURTON

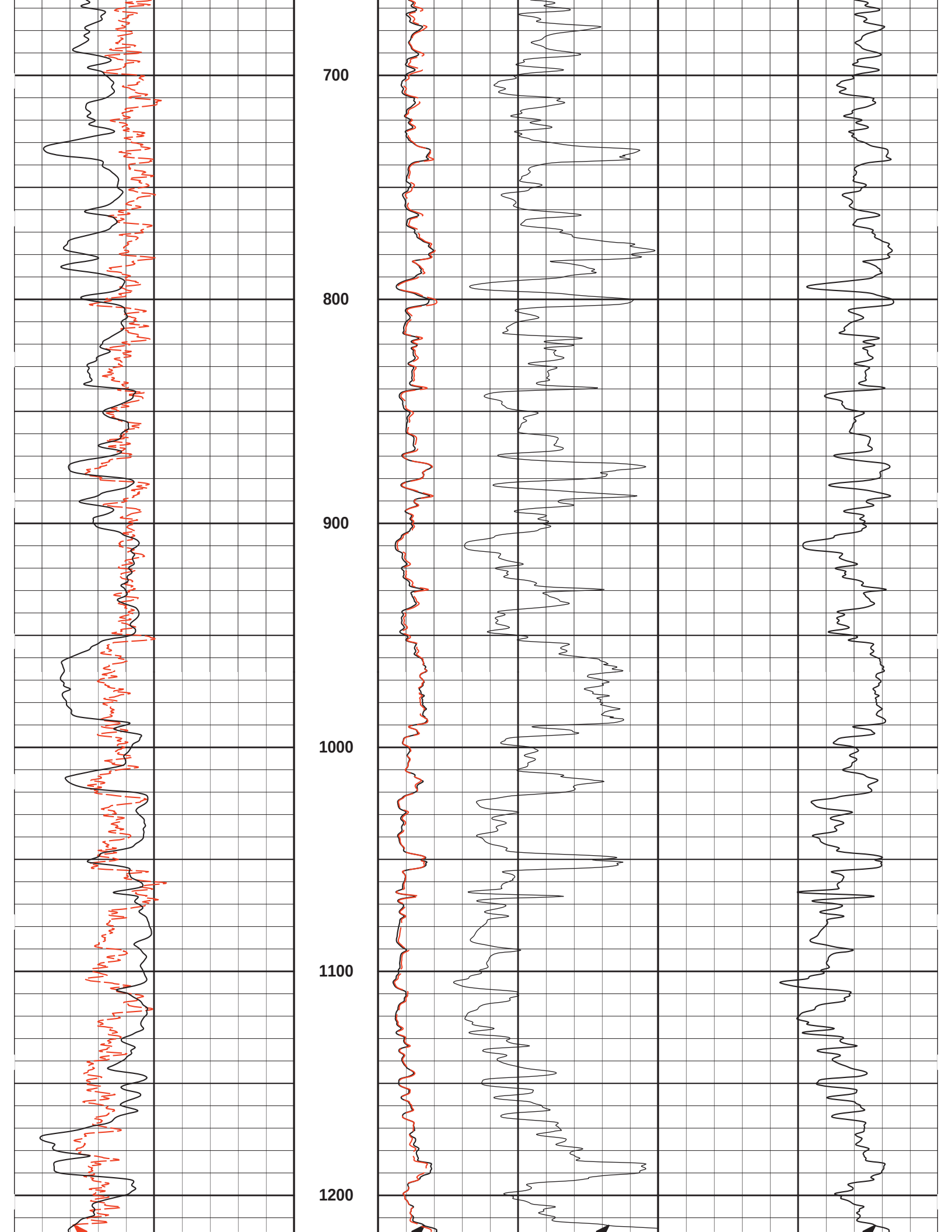
HALLIBURTON

Plot Time: 25-Mar-13 02:43:53
Plot Range: 550 ft to 4983 ft
Data: PIACENTINE 2-27\Well Based\DAQ-0001-002.01
Plot File: \\QC_PRINT\PGE_2IN

MAIN PASS

2" = 100'

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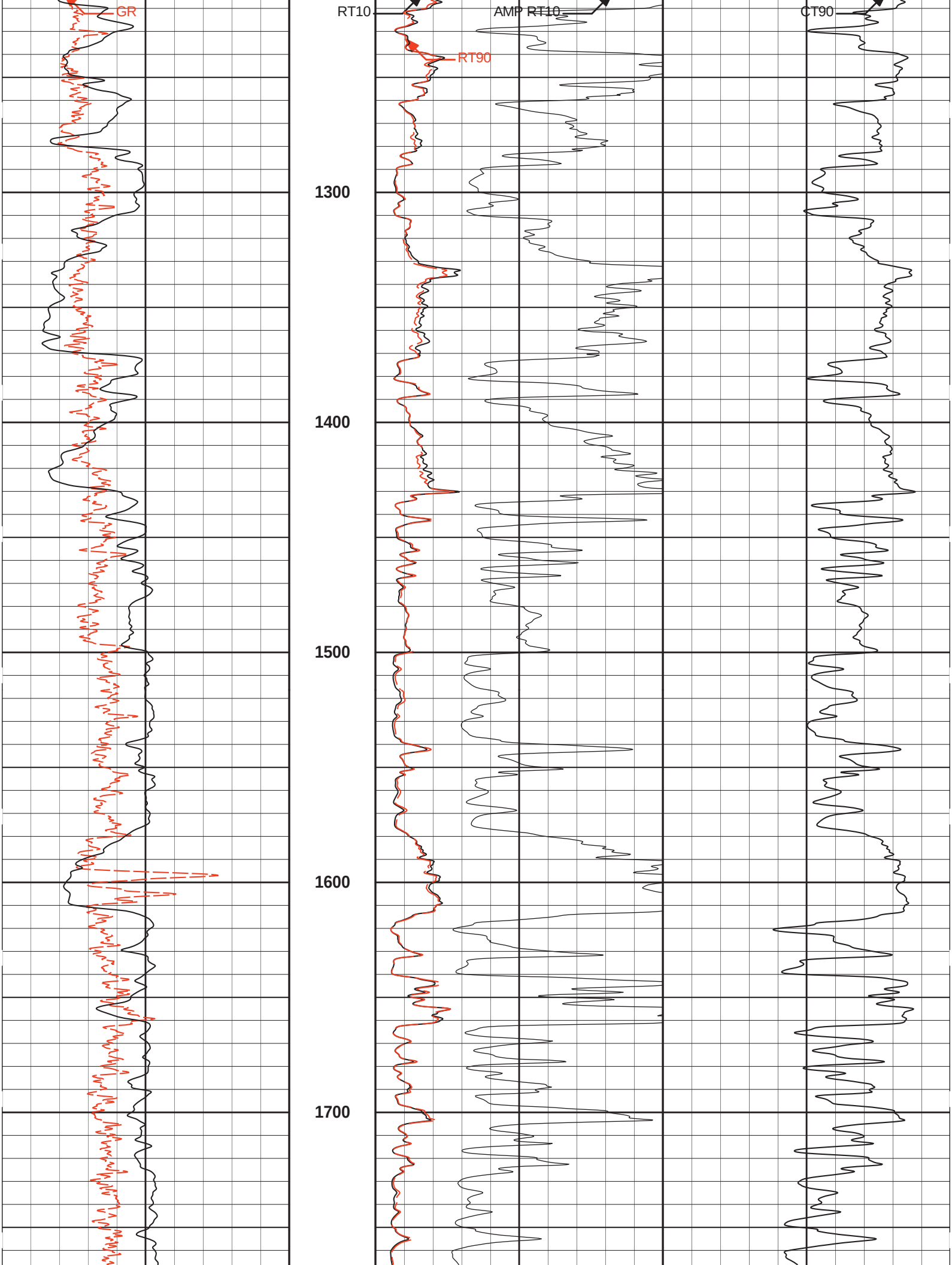
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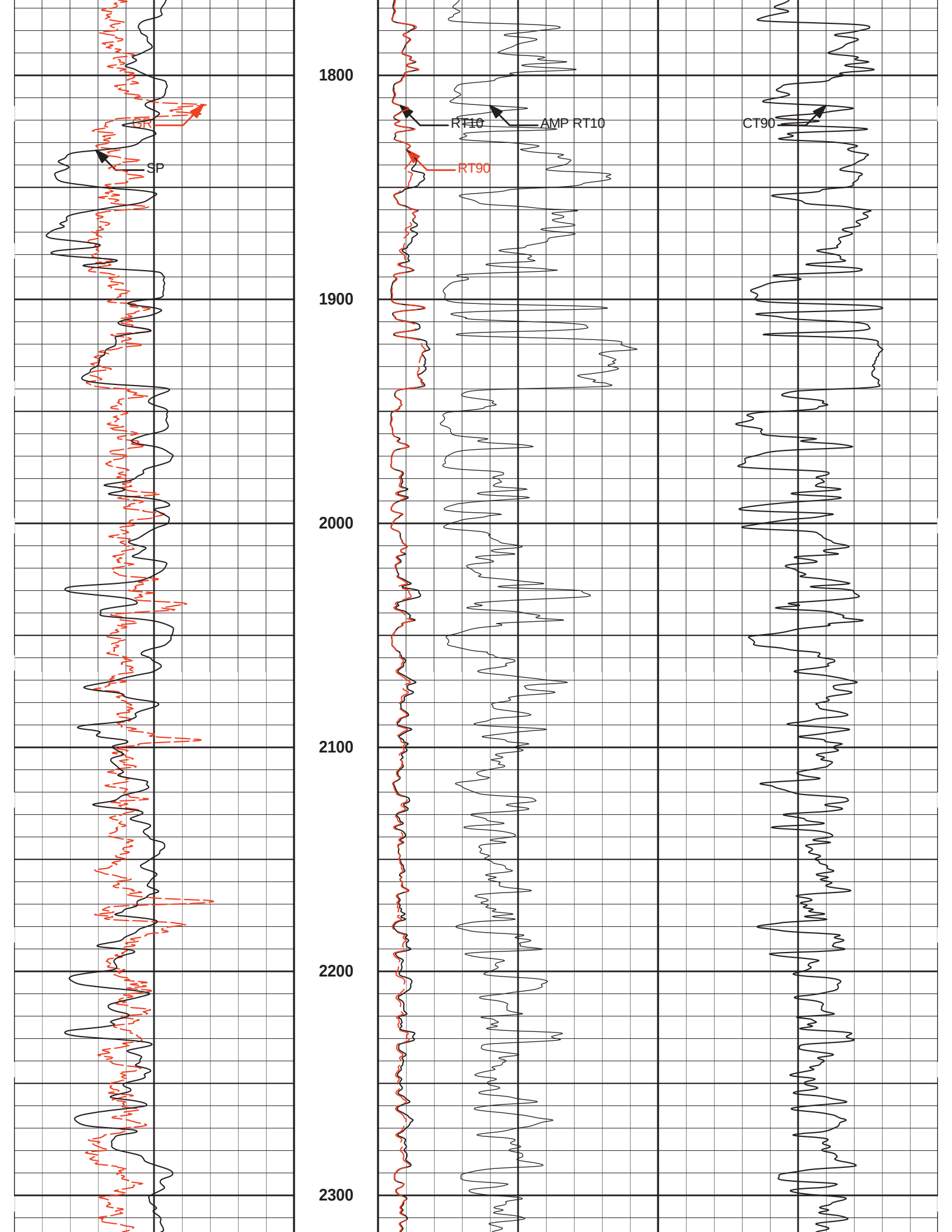
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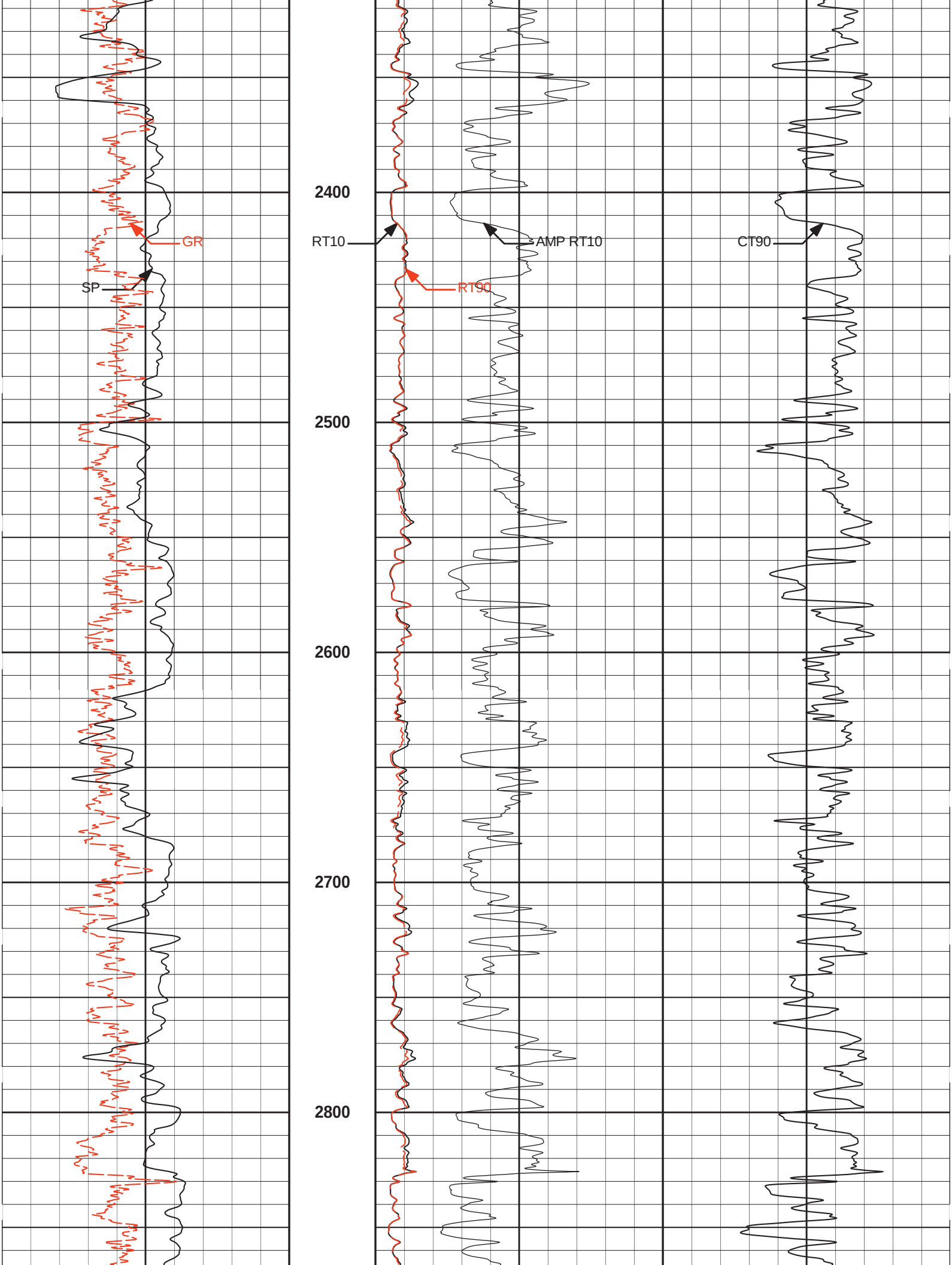
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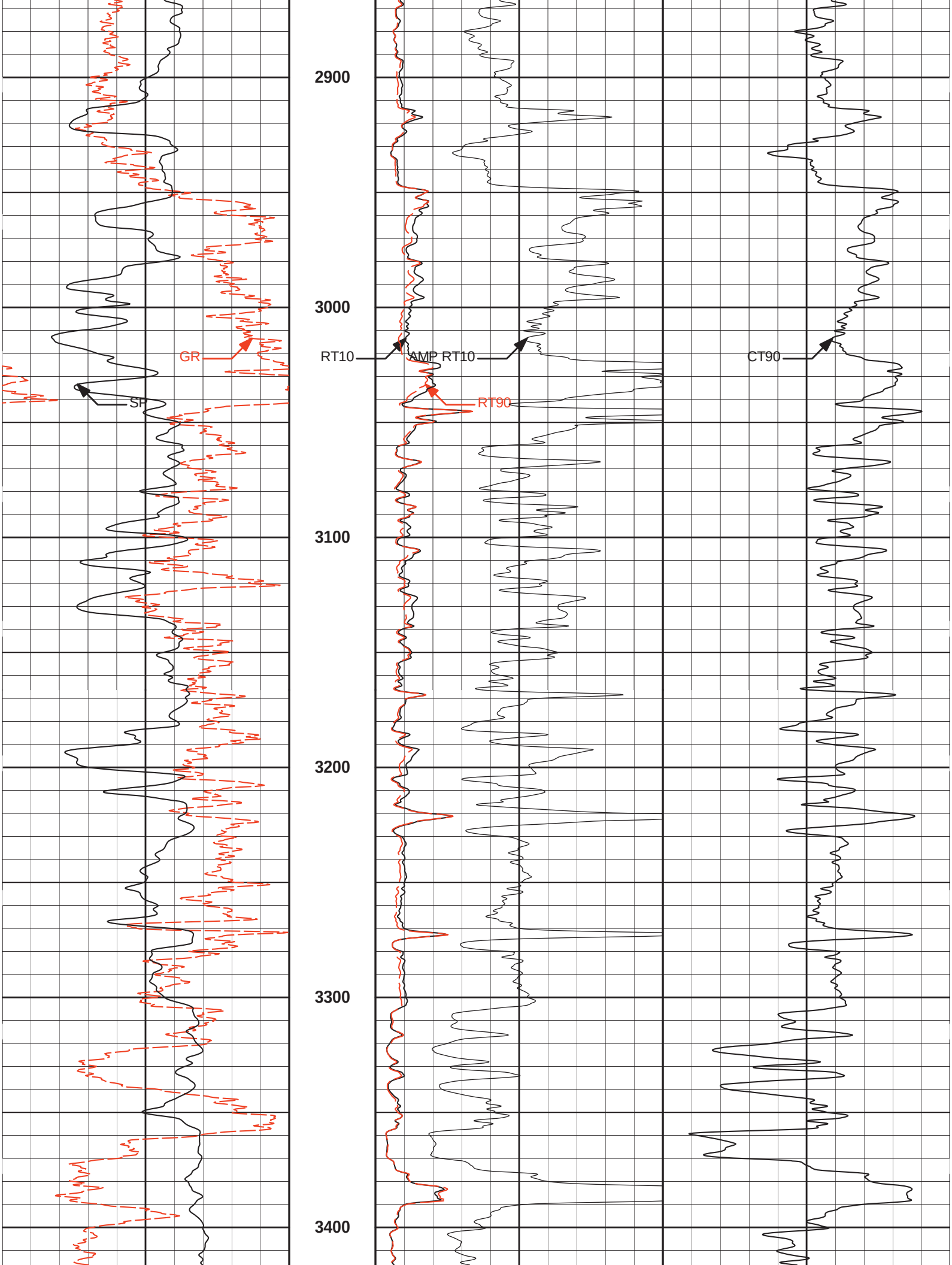
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AMP RT10
RT90
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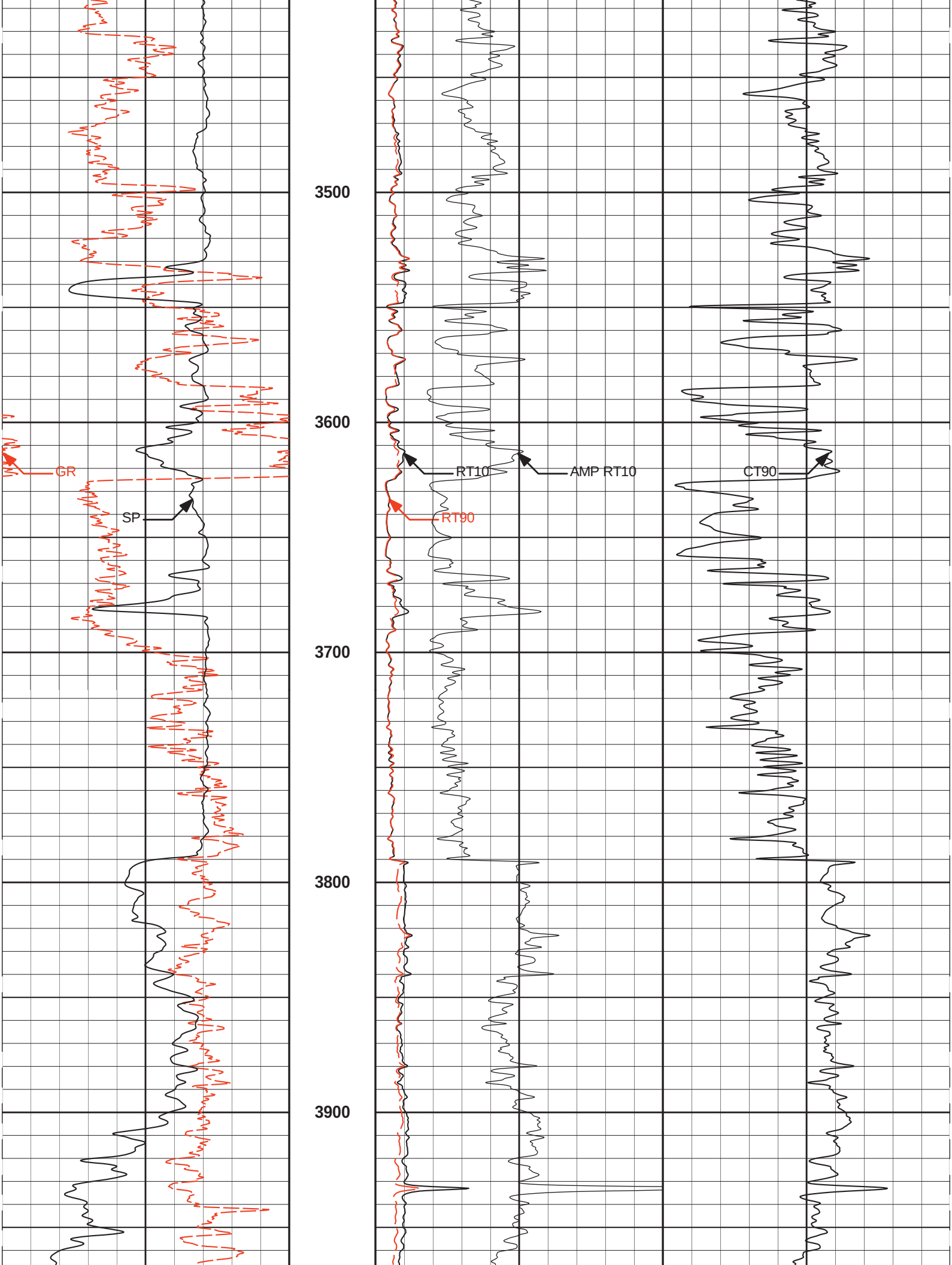
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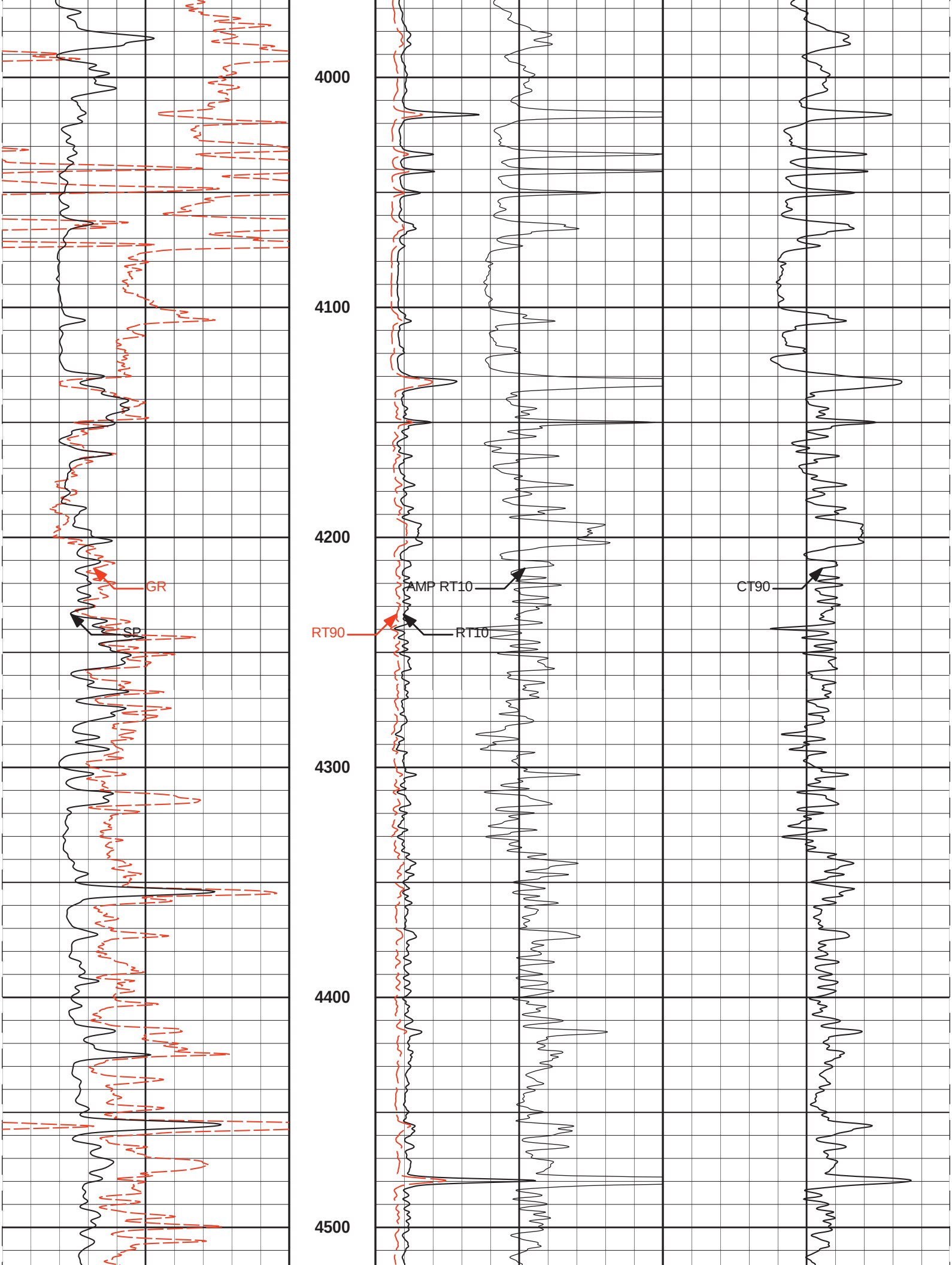
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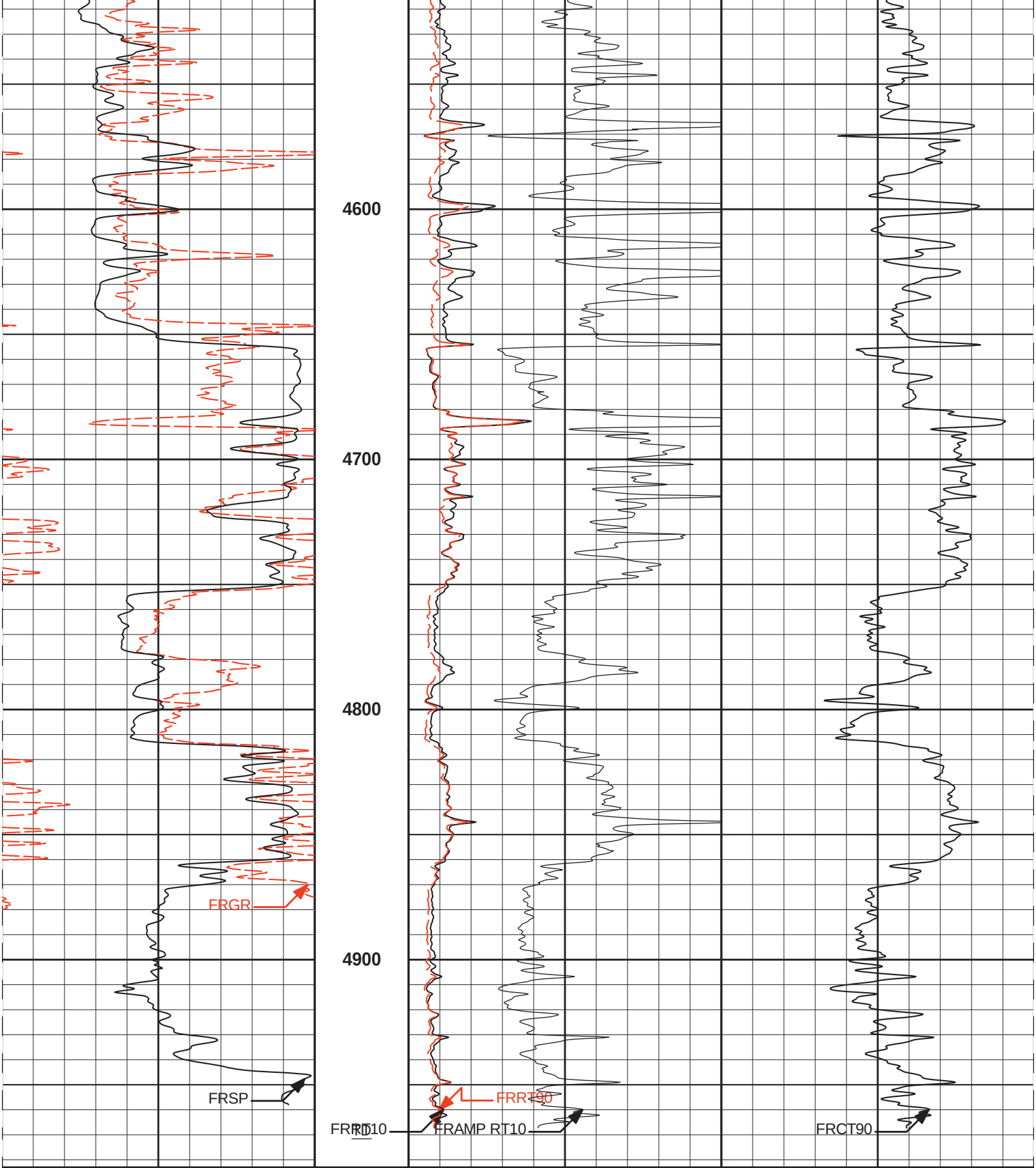
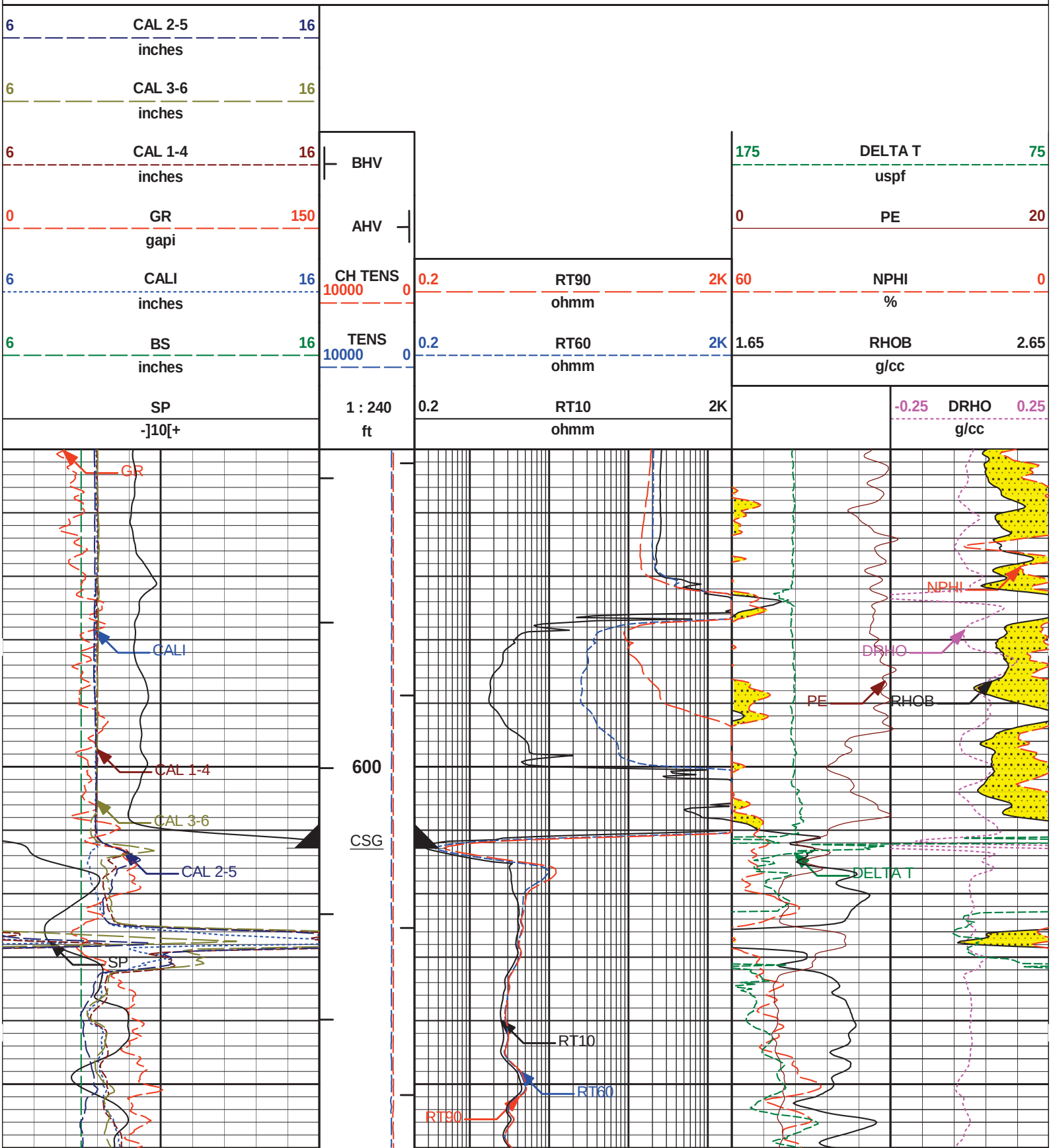
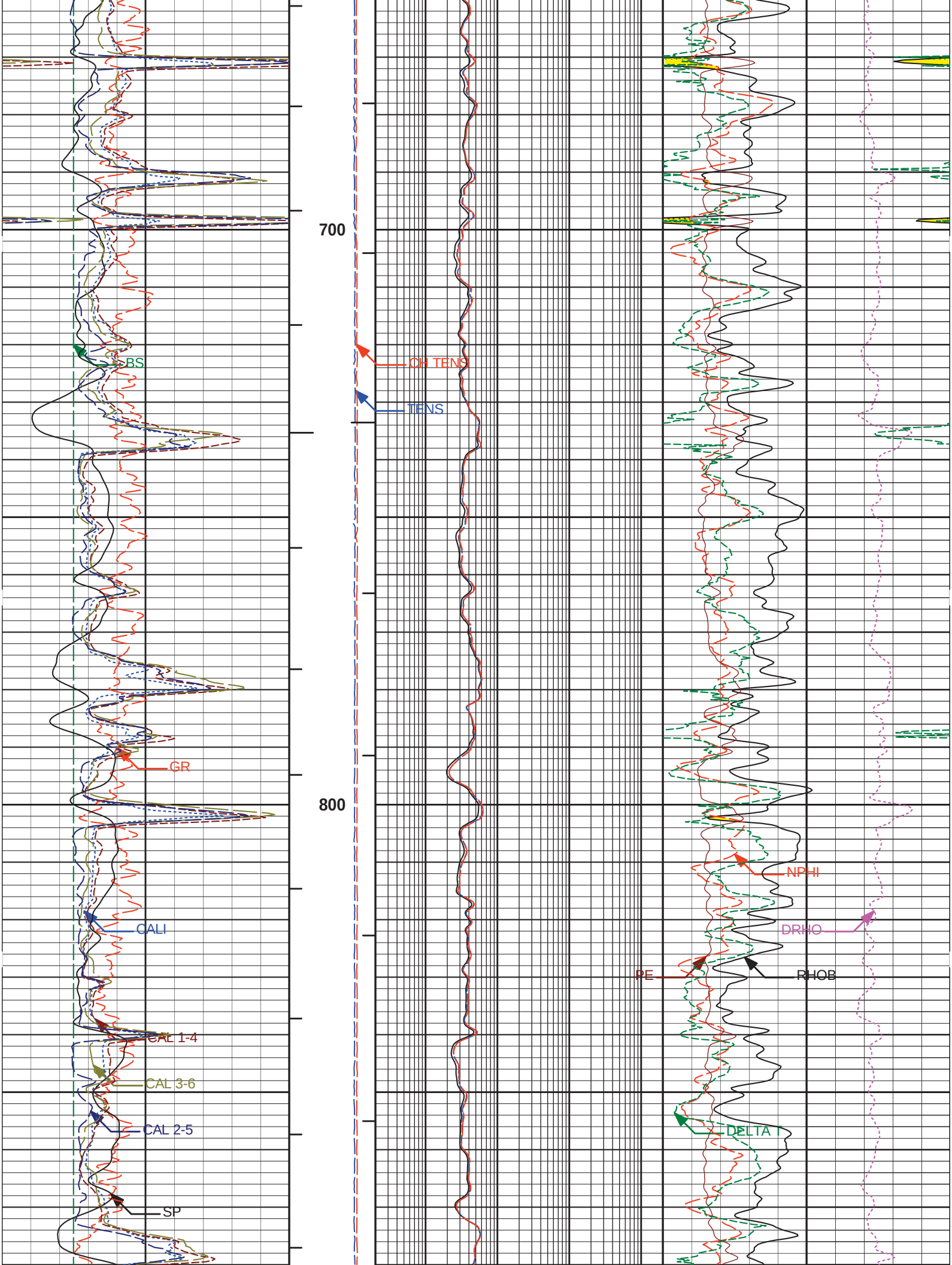


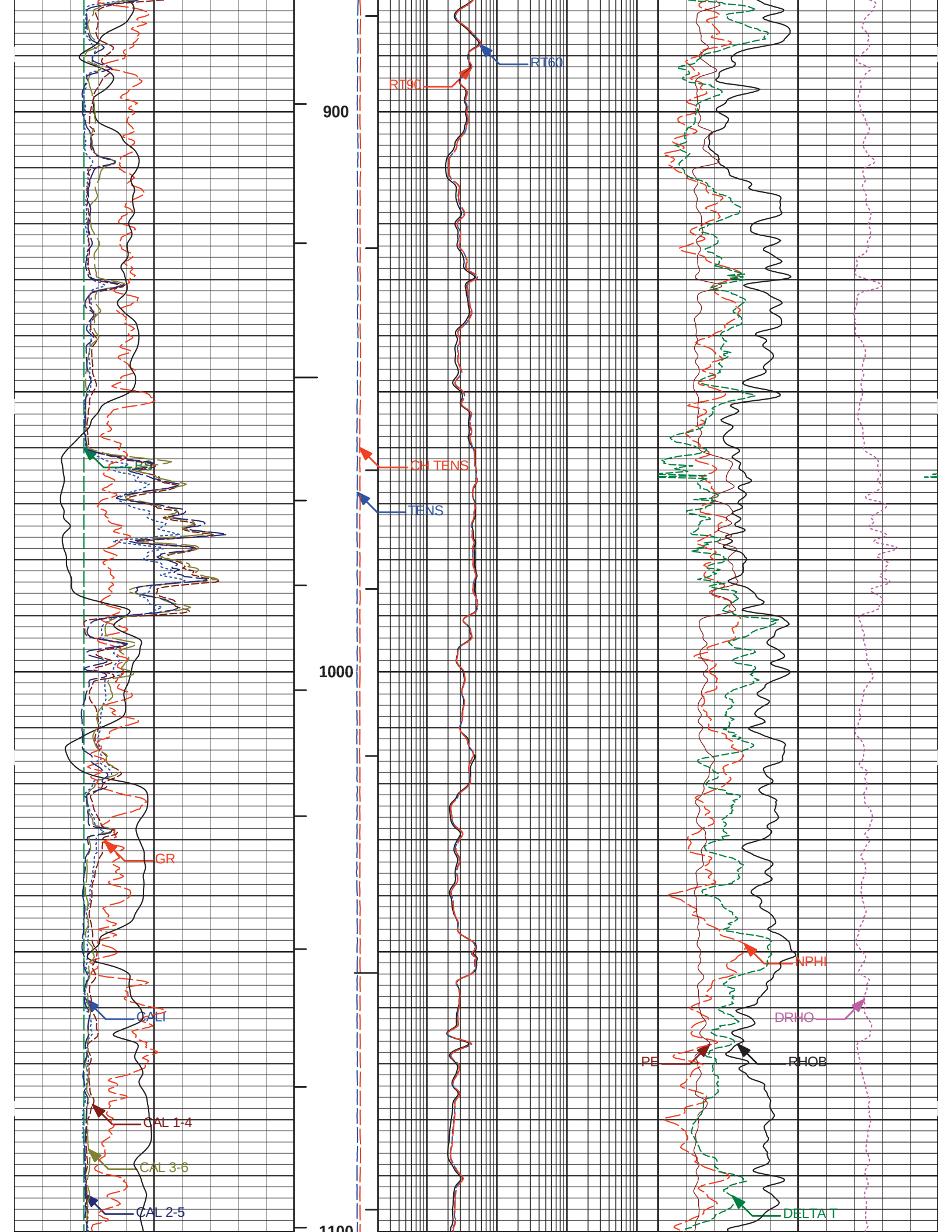
SP	1 : 600	0 AMP RT10 6	1000 CT90 0
-]10[+	ft	ohmm	mmo/m
0 GR 150		0 RT10 30	
gapi		ohmm	
		0 RT90 30	
		ohmm	

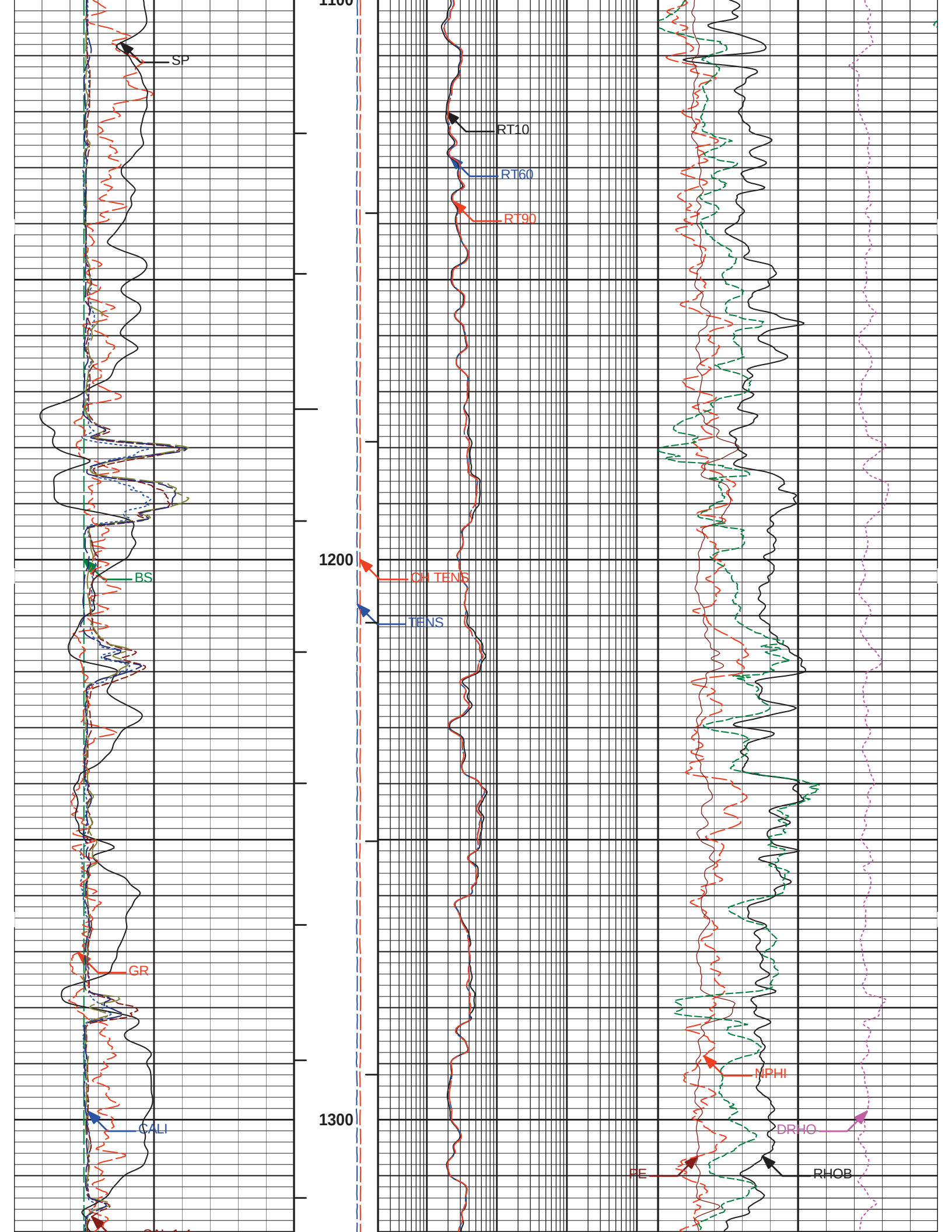
MAIN PASS

5" = 100'




700
800
BS
GR
CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
CH TENS
TENS
NPHI
DRHO
PE
RHOB
DELTA T


RT60
RT90
900
CH TENS
TENS
1000
GR
NPHI
CALI
DRHO
PE
RHOB
CAL 1-4
CAL 3-6
CAL 2-5
DELTA T
1100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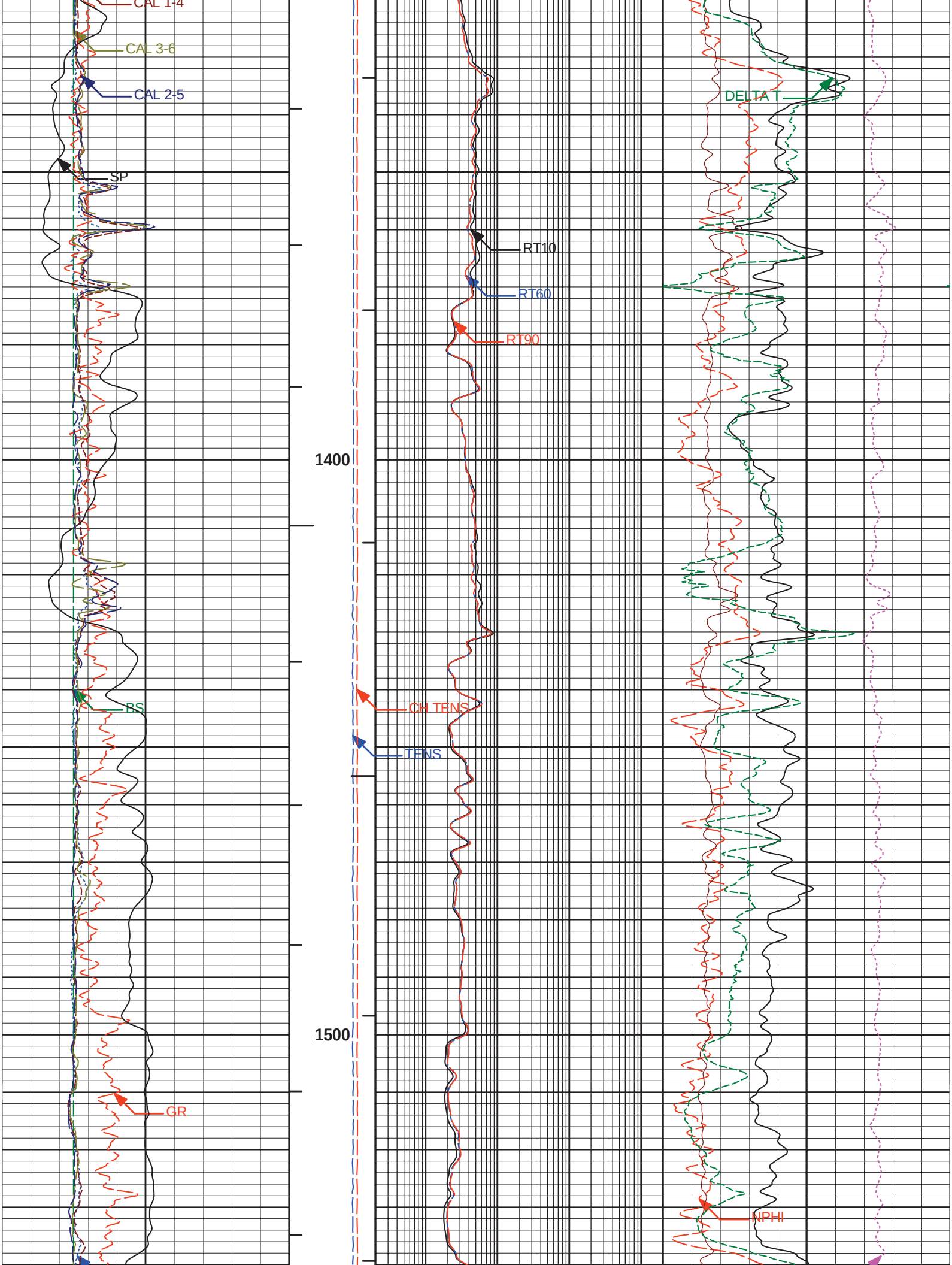
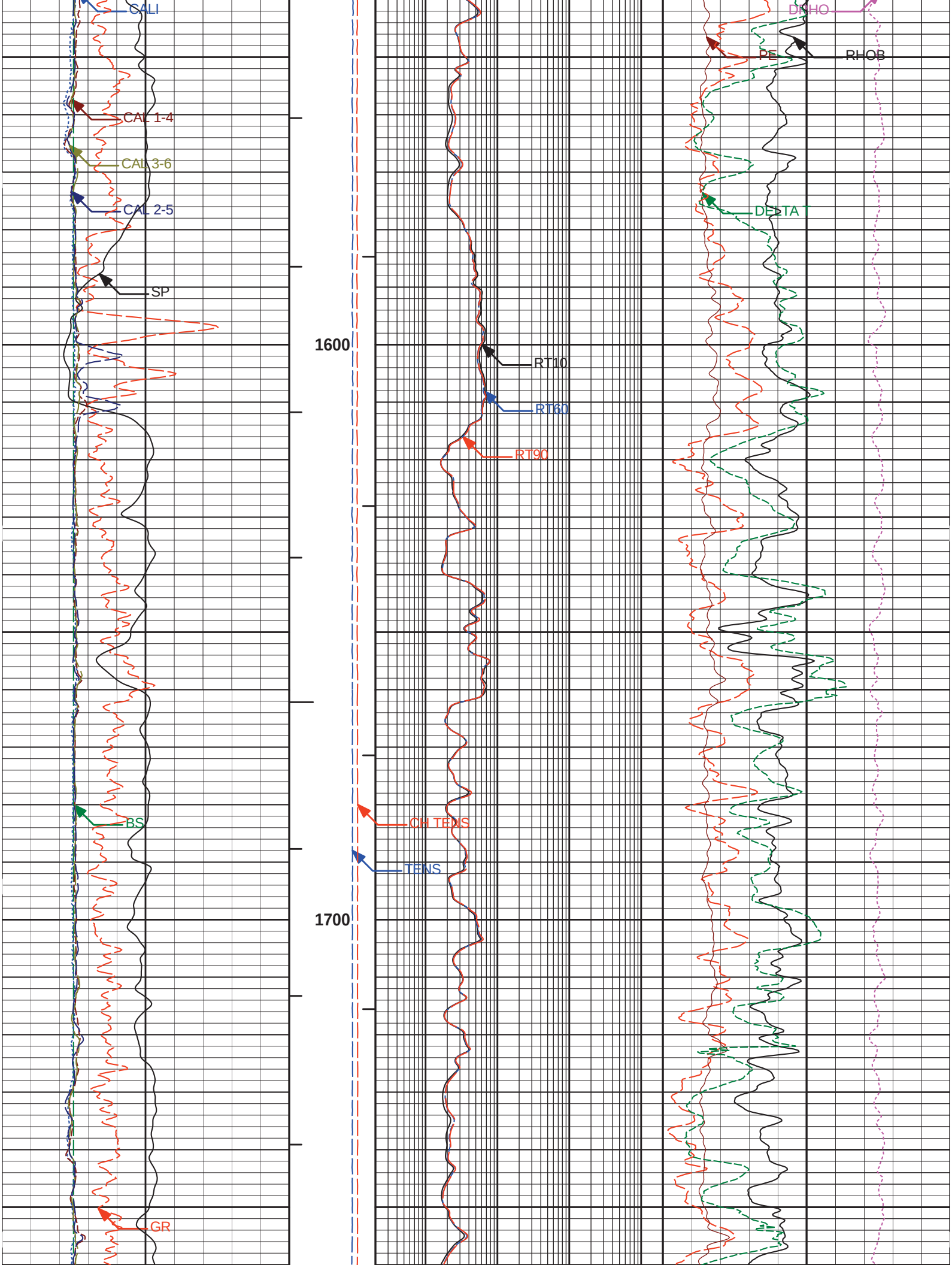
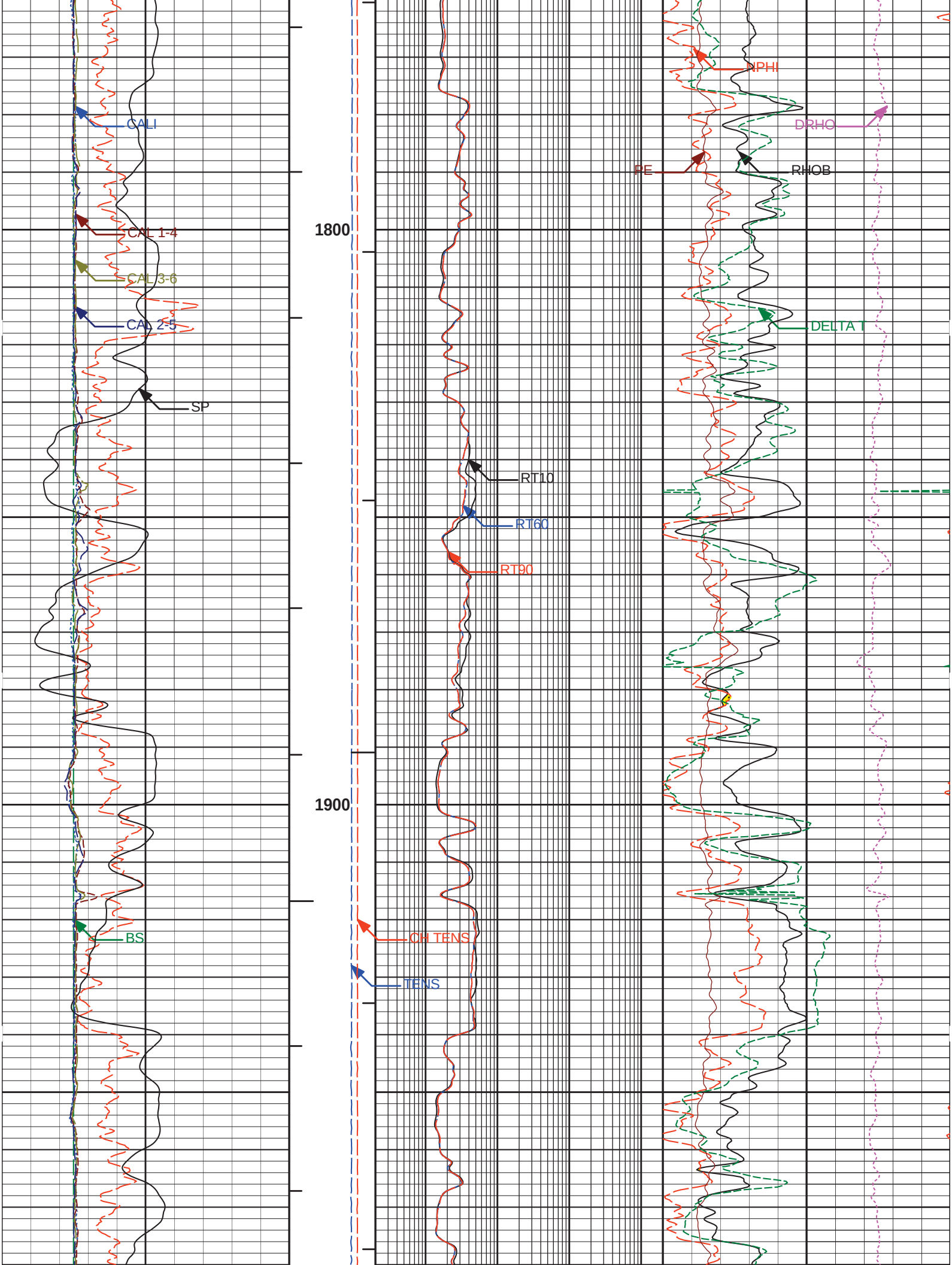
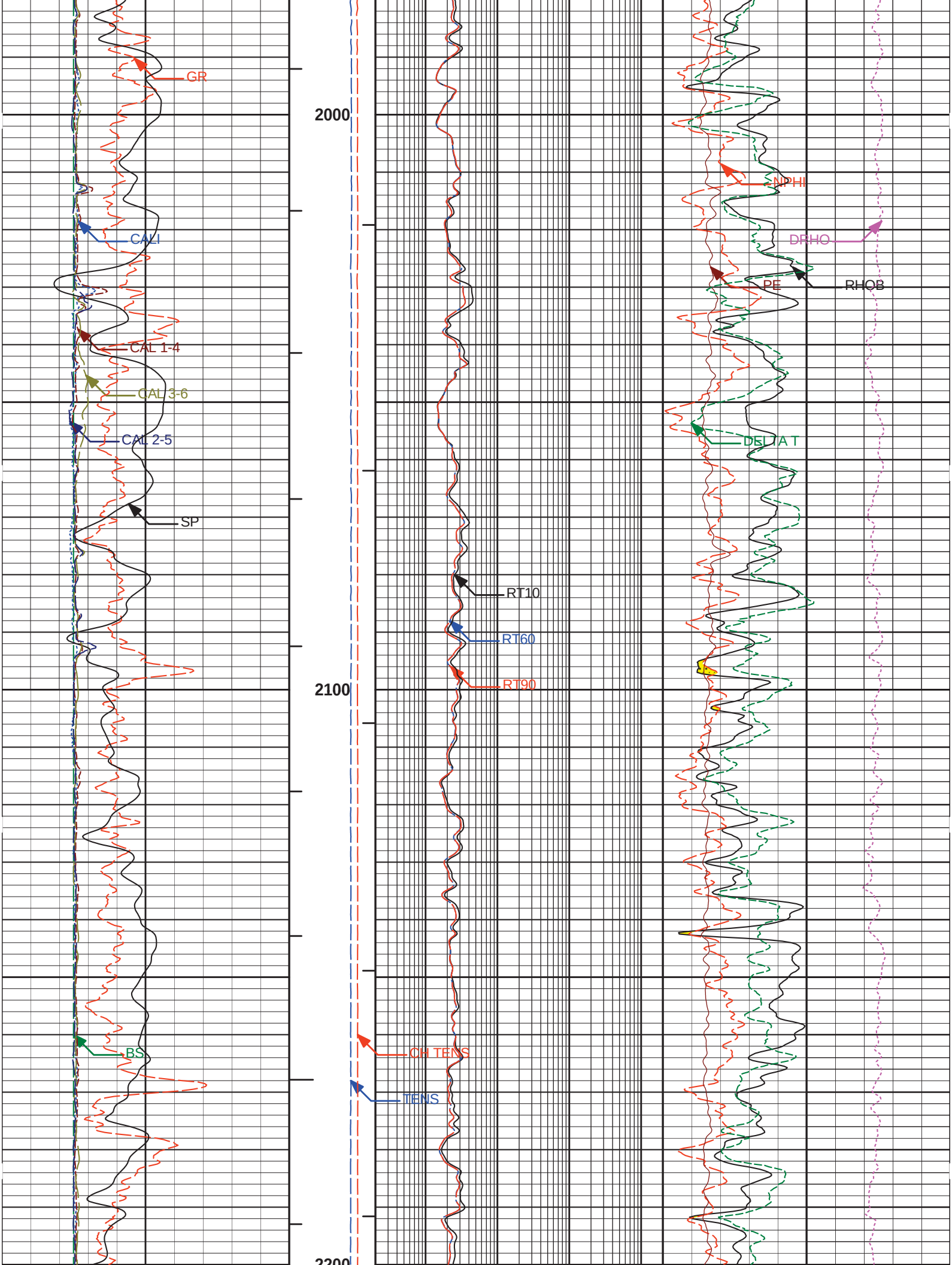
1200
1300
SP
RT10
RT60
RT90
BS
CH TENS
TENS
GR
CALI
NPHI
DRHO
PE
RHOB


CAL 1-4
CAL 3-6
CAL 2-5
SP
BS
GR
RT10
RT60
RT90
CH TENS
TENS
DELTA T
NPHI
1400
1500


CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
BS
GR
1600
1700
RT10
RT60
RT90
CH TENS
TENS
DRHO
PE
RHOB
DELTA T


CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
BS
1800
1900
RT10
RT60
RT90
CH TENS
TENS
NPHI
DRHO
PE
RHOB
DELTA T


GR
CALI
CAL 1-4
CAL 3-6
CAL 2-5
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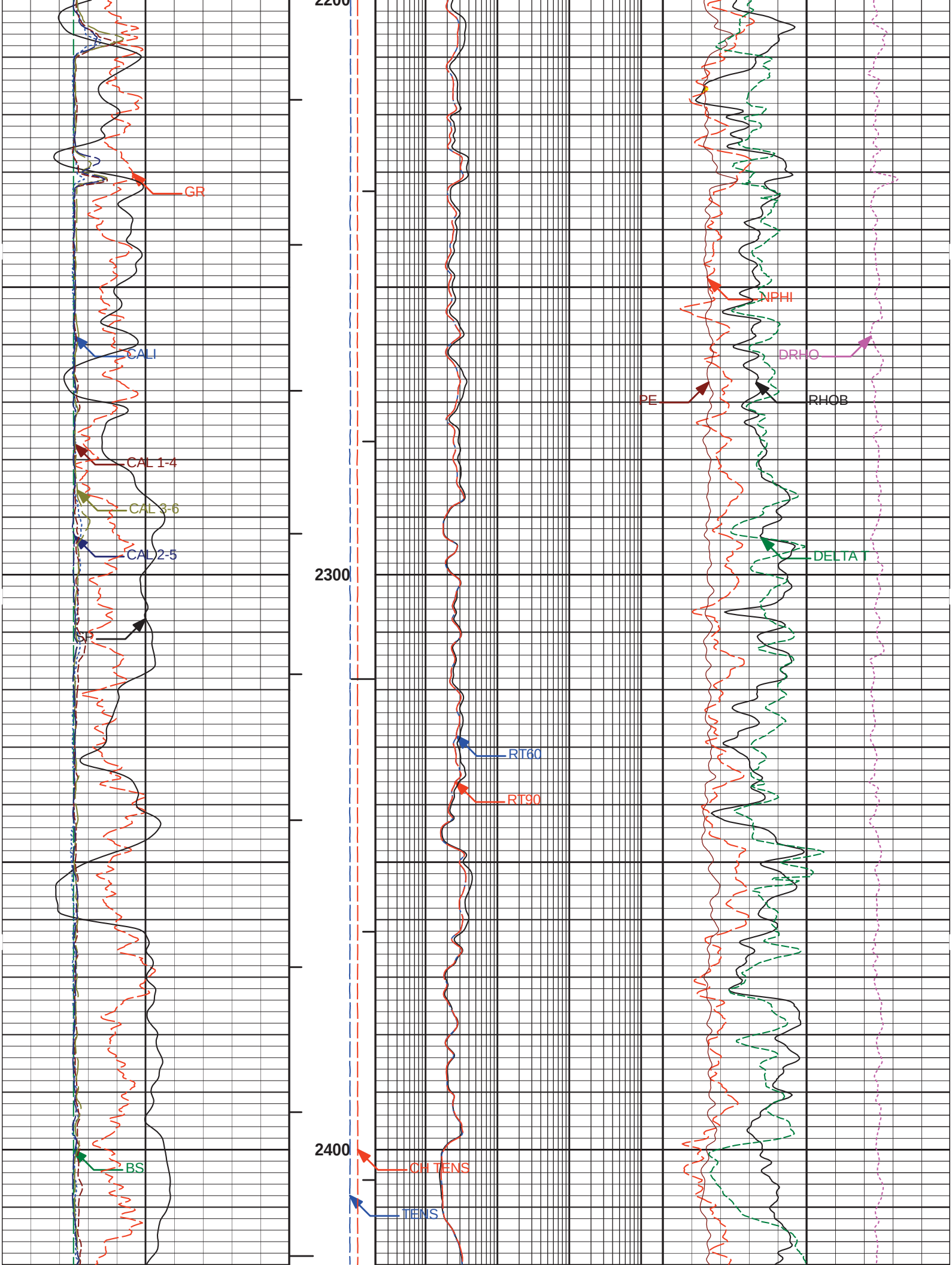
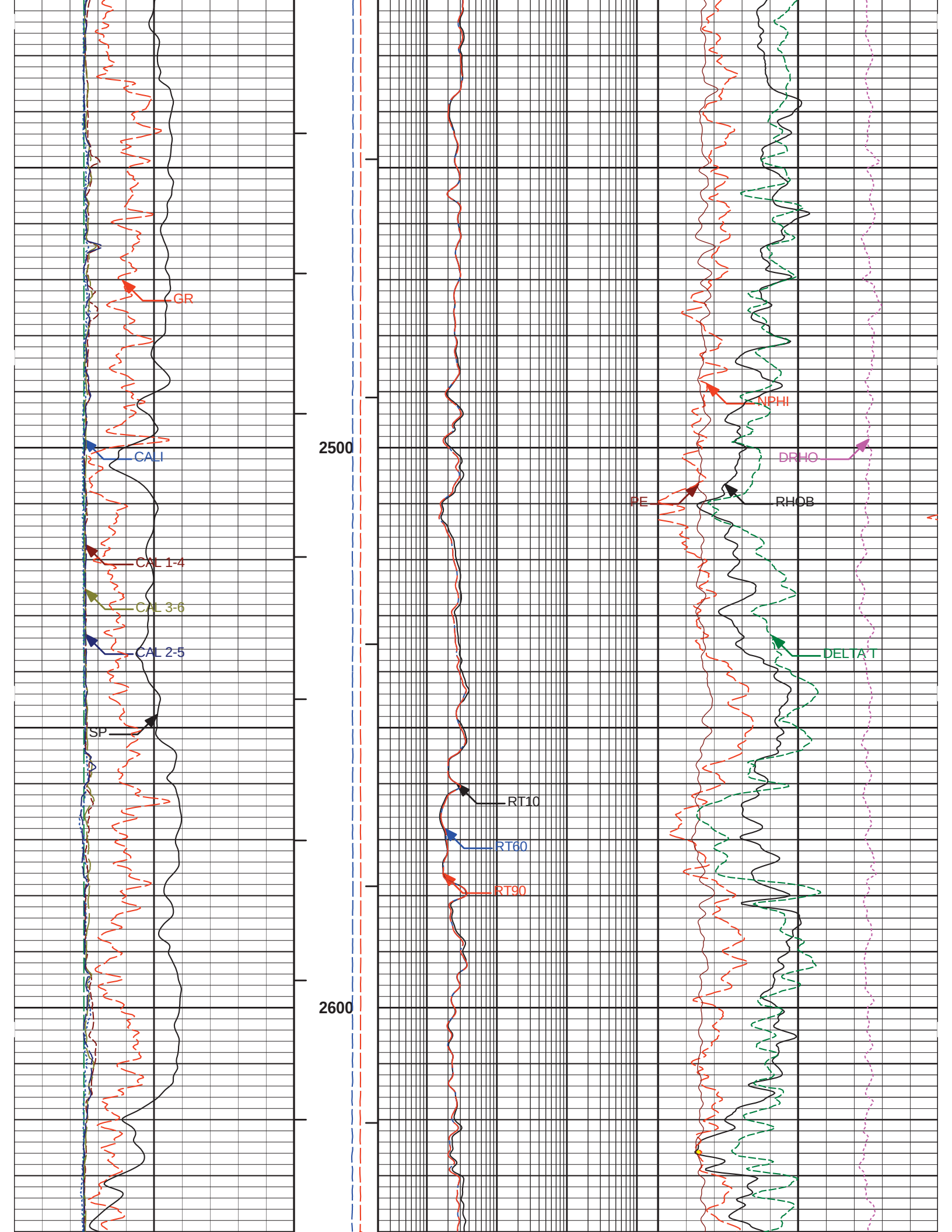
2100
2200
RT10
RT60
RT90
CH TENS
TENS
NPHI
DRHO
PE
RHOB
DELTA T


2200
2300
2400
GR
CALI
CAL 1-4
CAL 3-6
CAL2-5
SP
BS
RT60
RT90
CH TENS
TENS
NPHI
DRHO
PE
RHOB
DELTA T


GR
CALI
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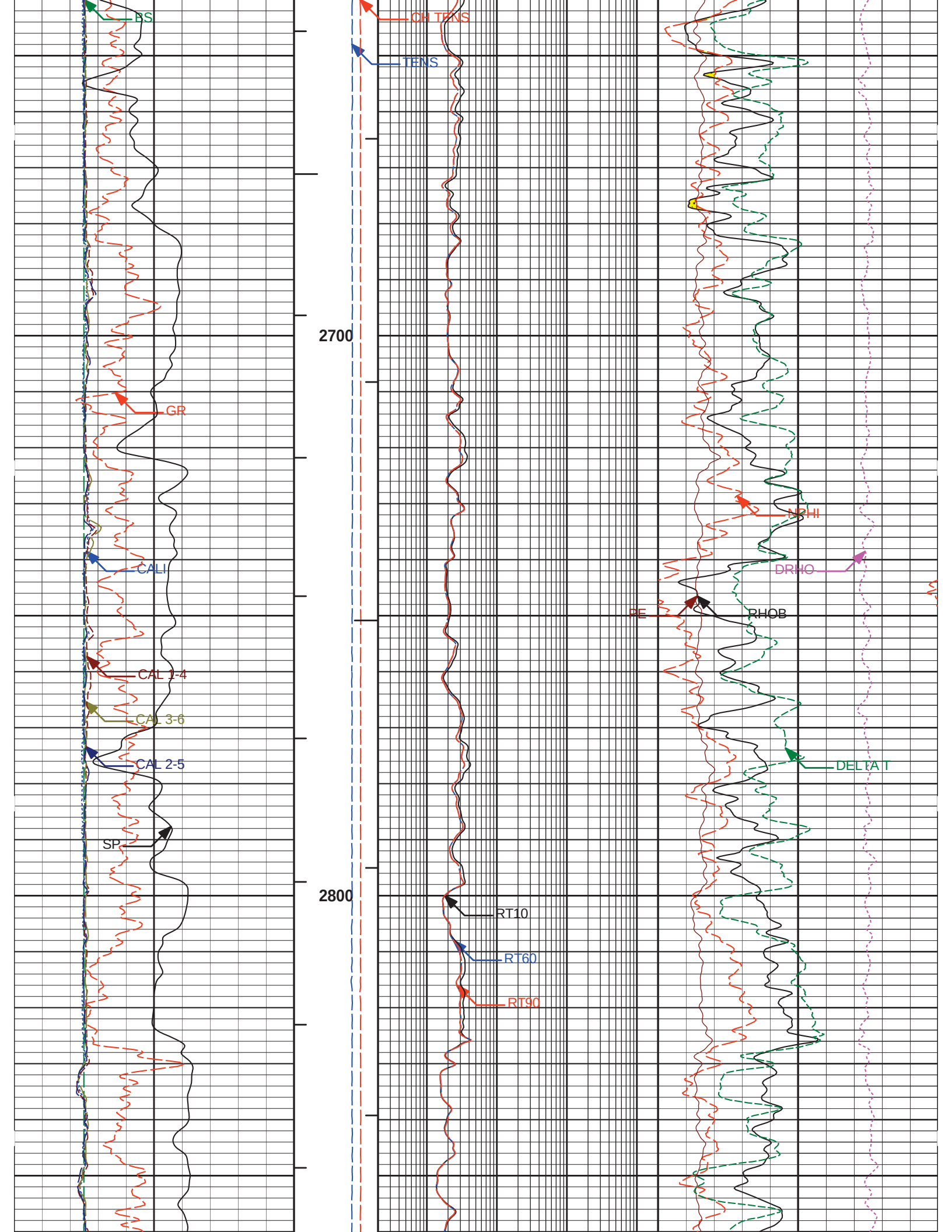
CAL 2-5
SP
2500
2600
RT10
RT60
RT90
NPHI
DRHO
PE
RHOB
DELTA T


BS
CH TENS
TENS
2700
GR
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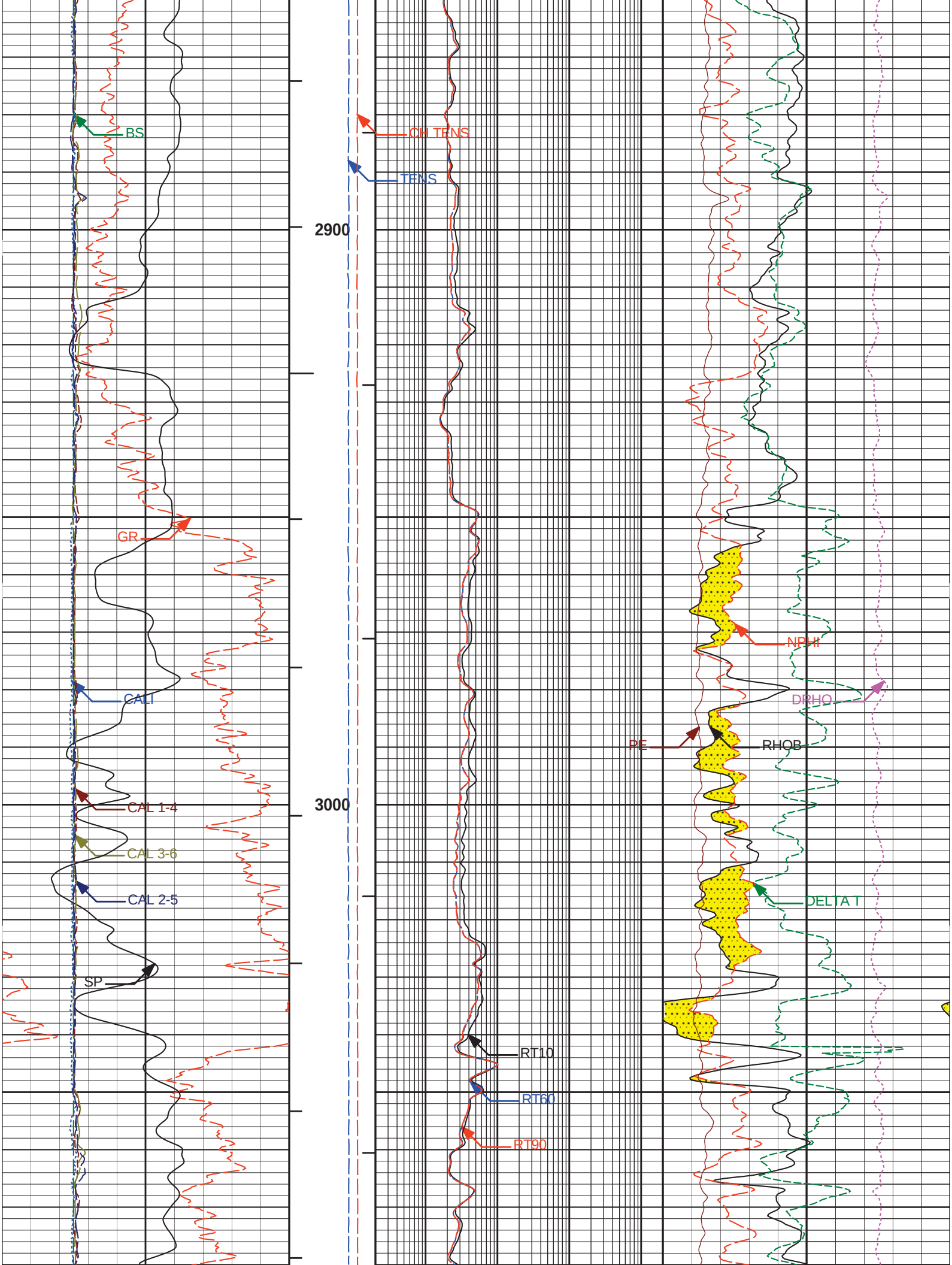
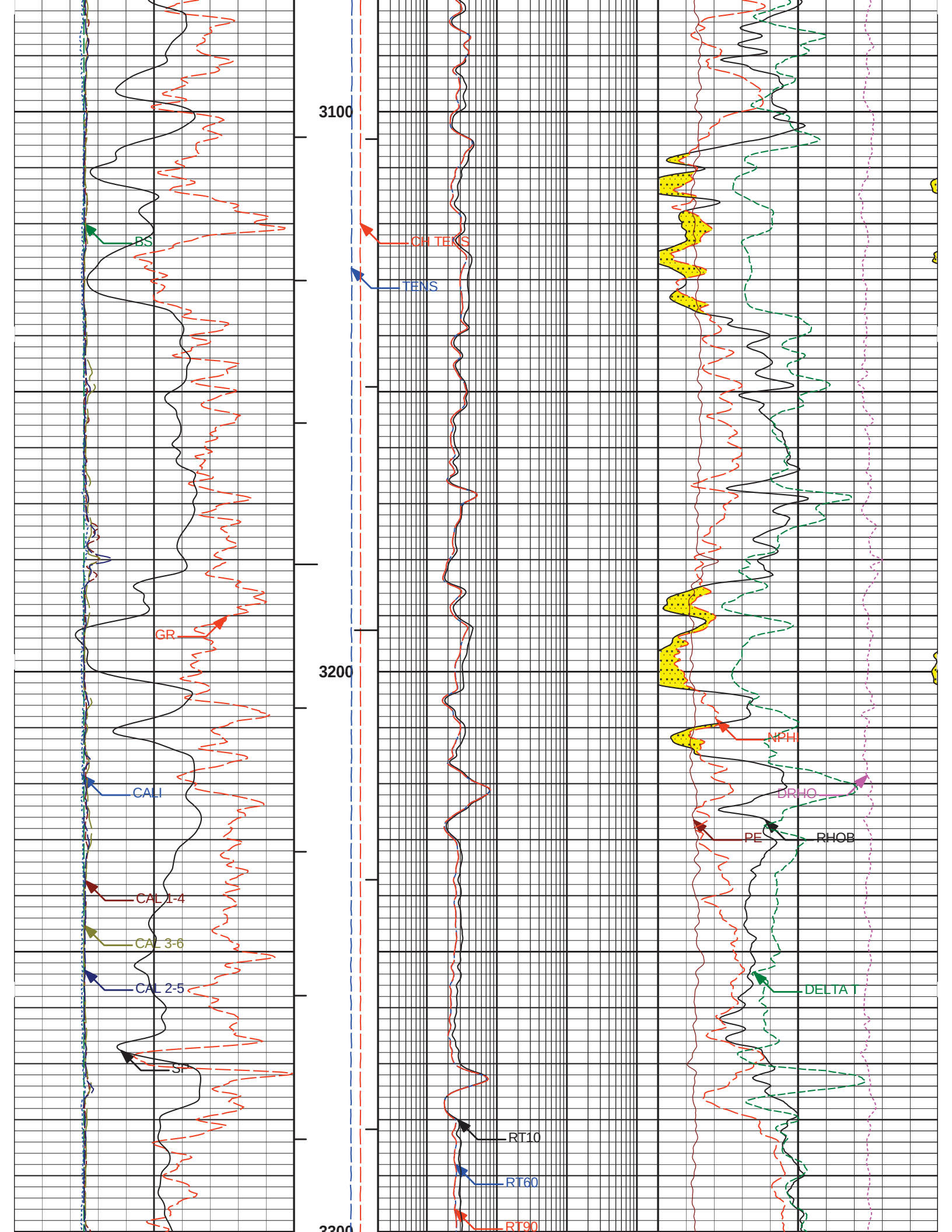
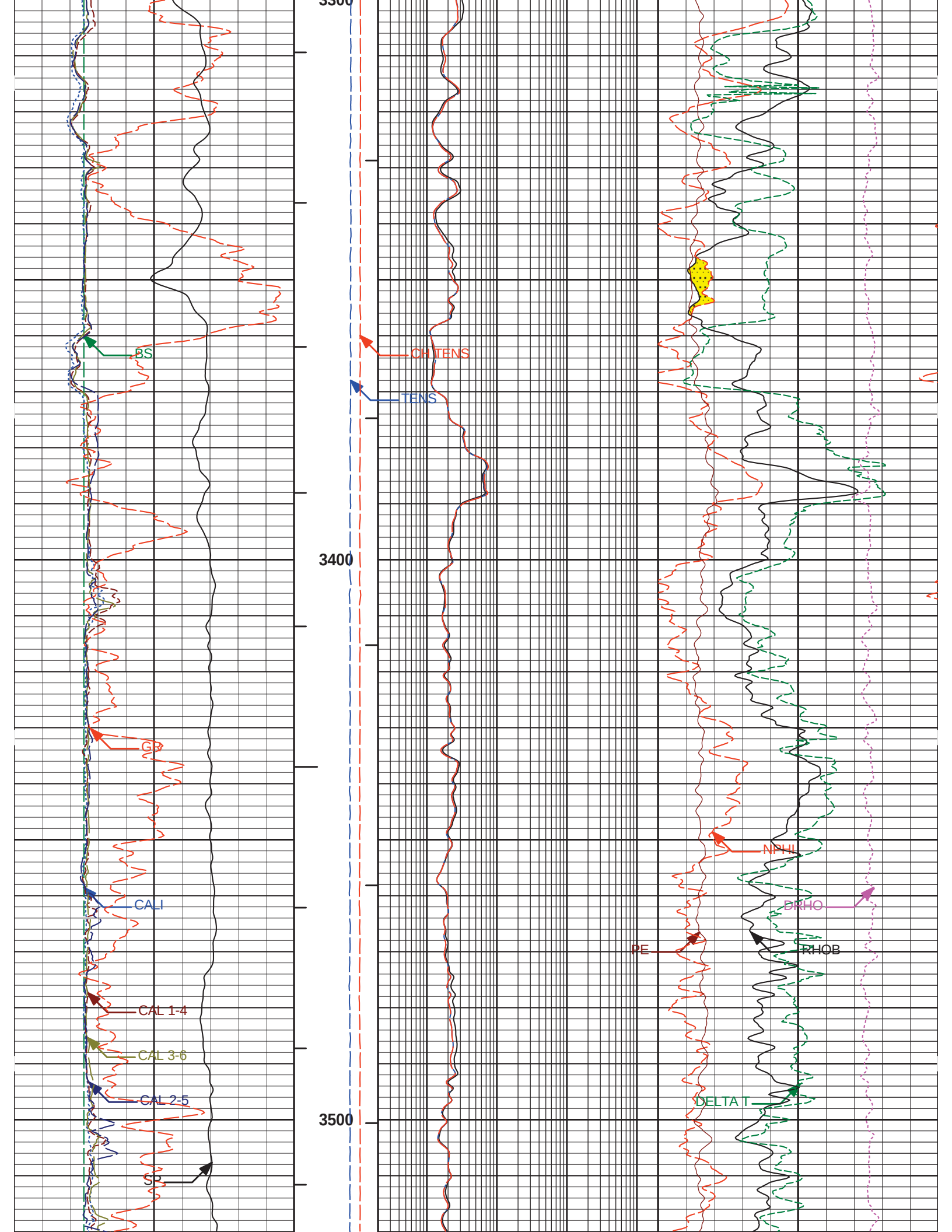
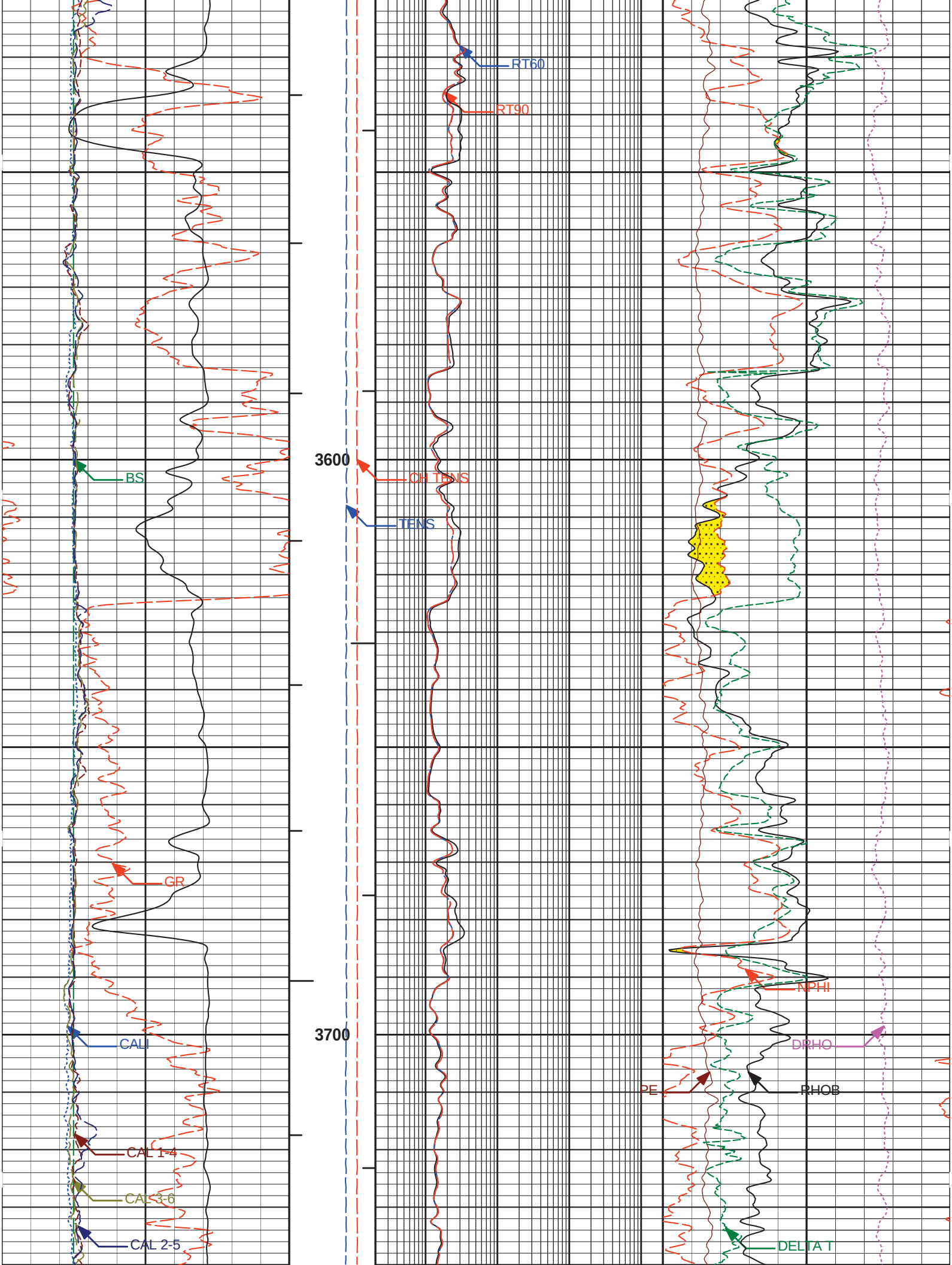
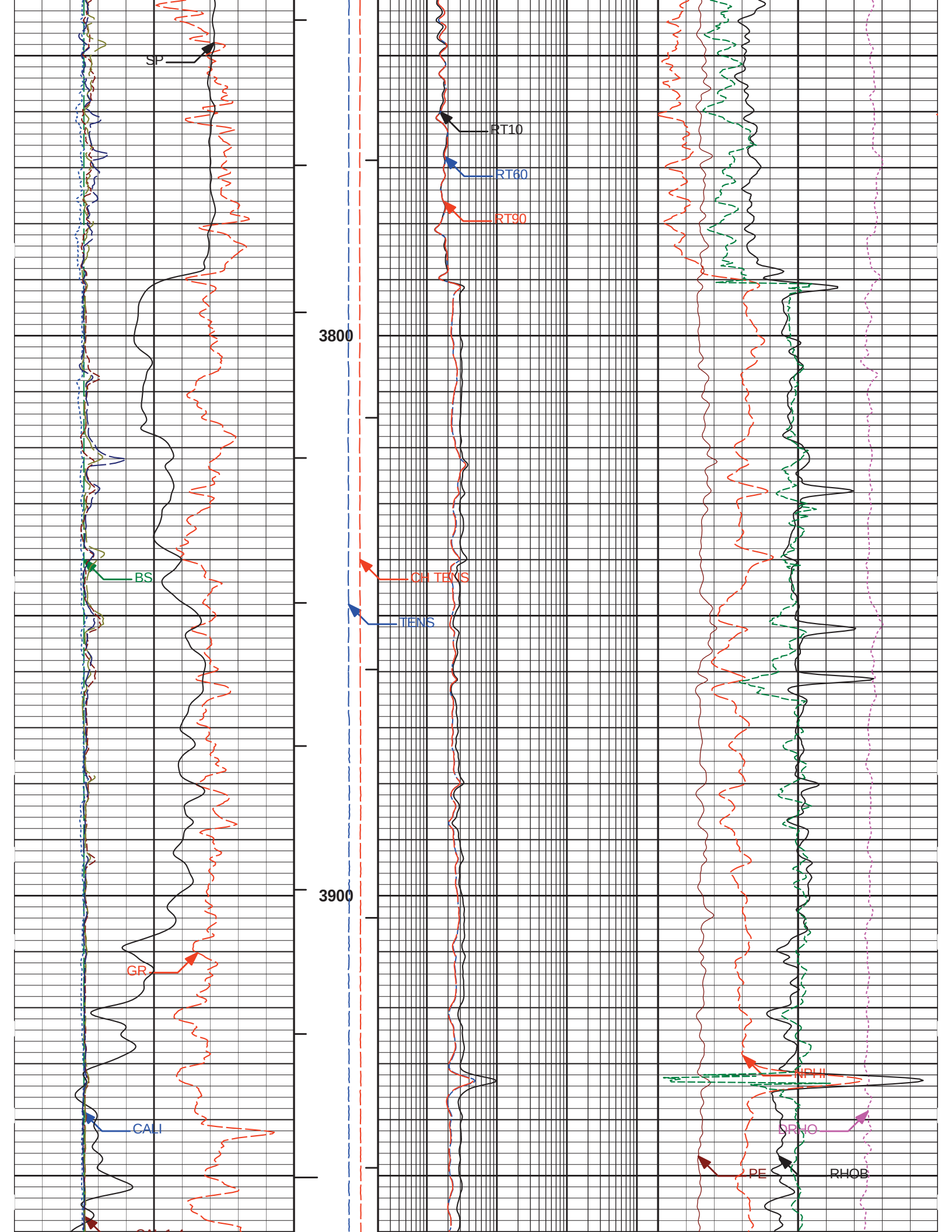
CALI
DRHO
PE
RHOB
CAL 1-4
CAL 3-6
CAL 2-5
DELTA T
SP
2800
RT10
RT60
RT90

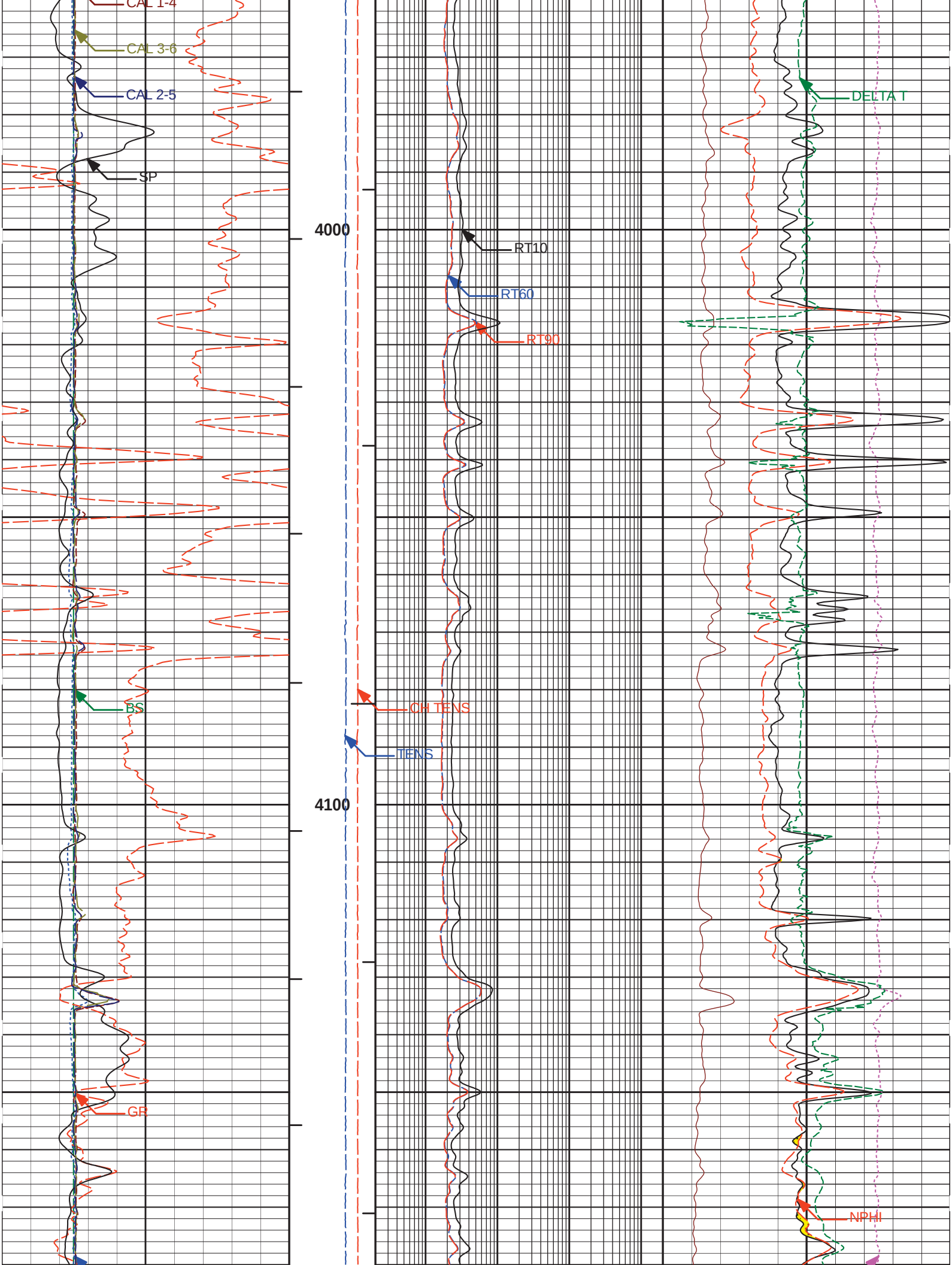

BS
CH TENS
TENS
2900
GR
NPHI
CALI
DRHO
PE
RHOB
3000
CAL 1-4
CAL 3-6
CAL 2-5
DELTA T
SP
RT10
RT60
RT90

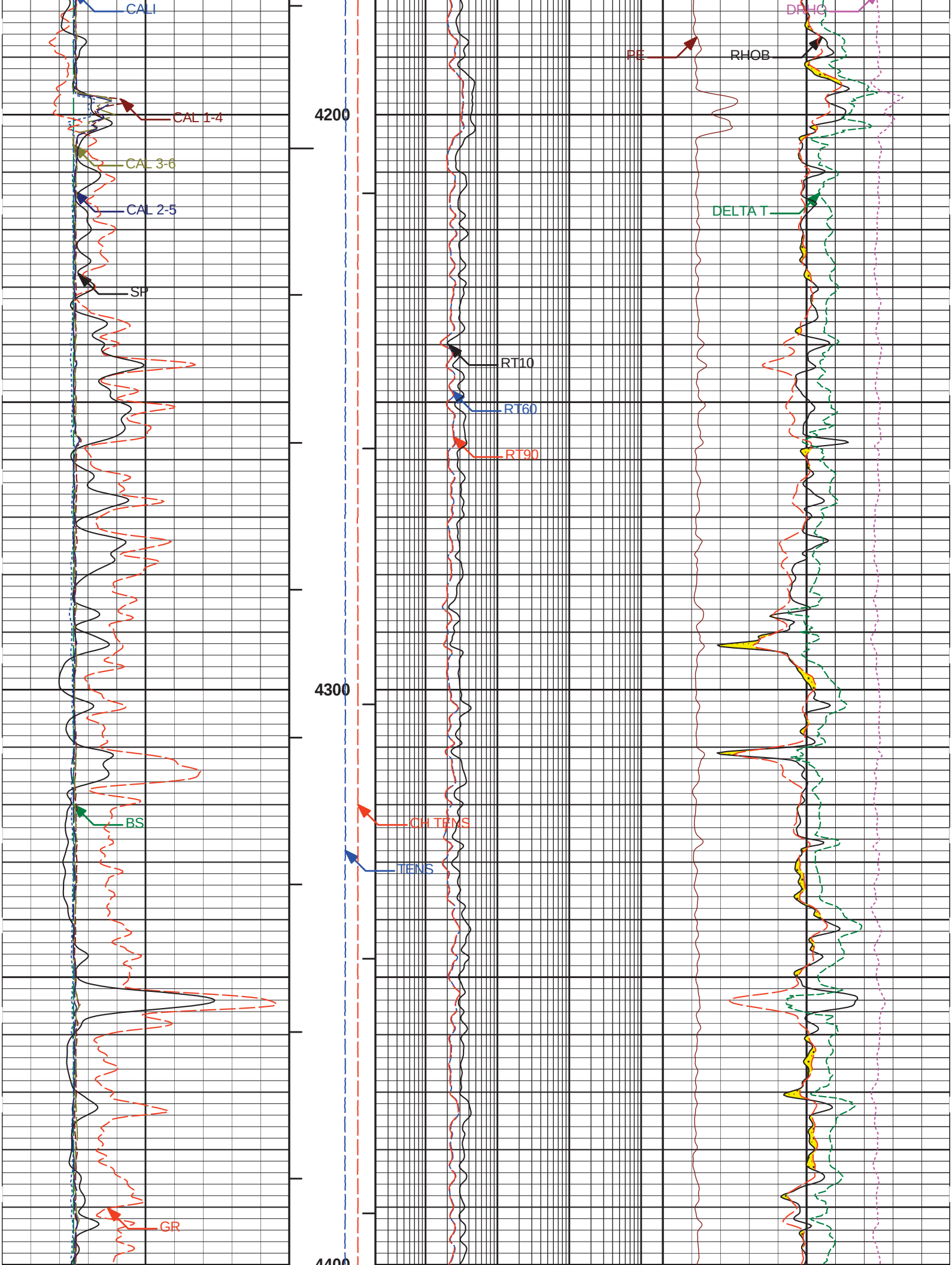

3100
3200
3300
BS
CH TENS
TENS
GR
CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
RT10
RT60
RT90
NPHI
DRHO
PE
RHOB
DELTA T

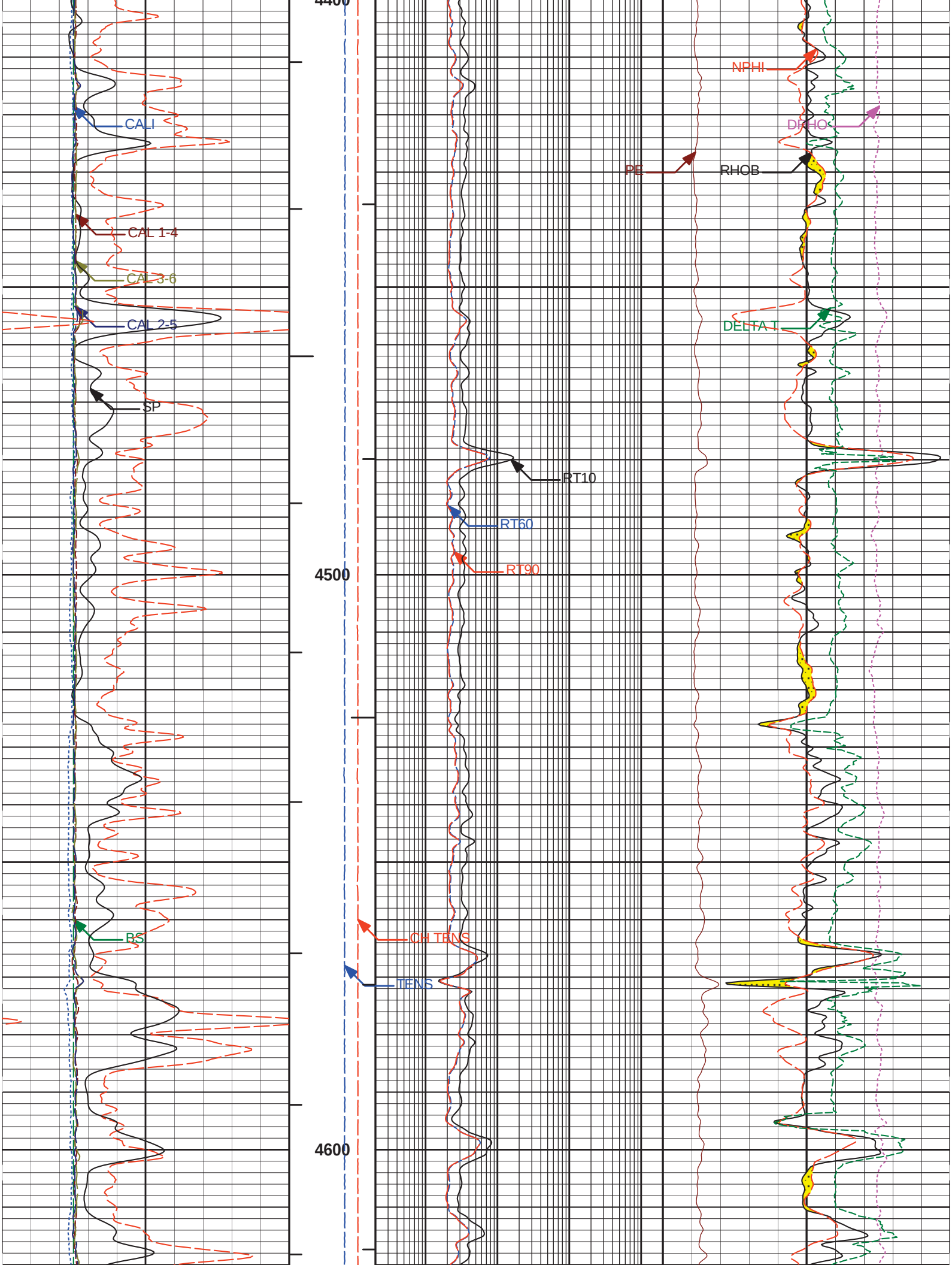

3300
3400
3500
BS
CHTENS
TENS
GR
CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
NPHI
DPHO
PE
RHOB
DELTA T

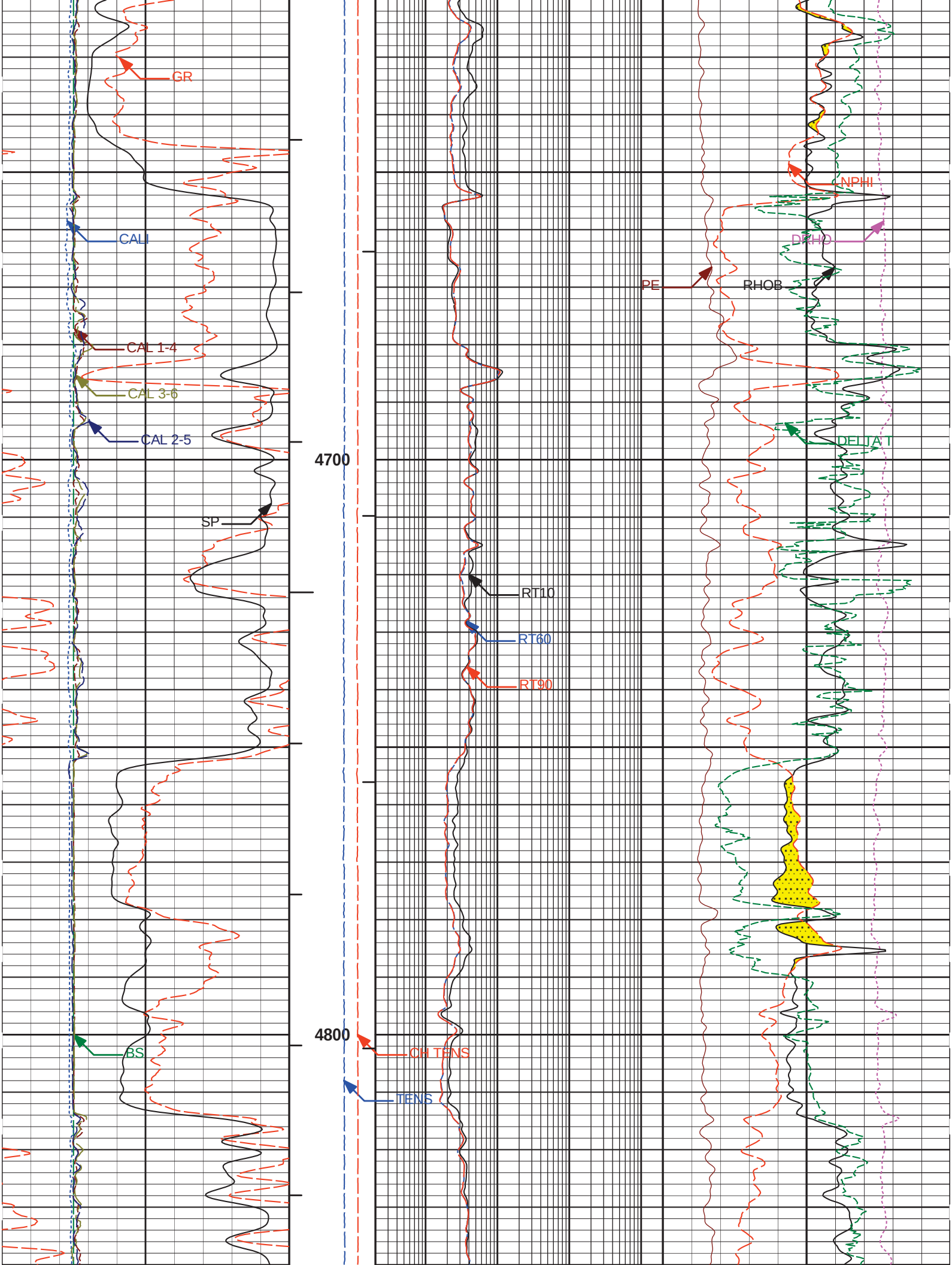

RT60
RT90
3600
CH TENS
TENS
BS
GR
NPHI
3700
CALI
DRHO
PE
RHOB
CAL 1-4
CAL 3-6
CAL 2-5
DELTA T

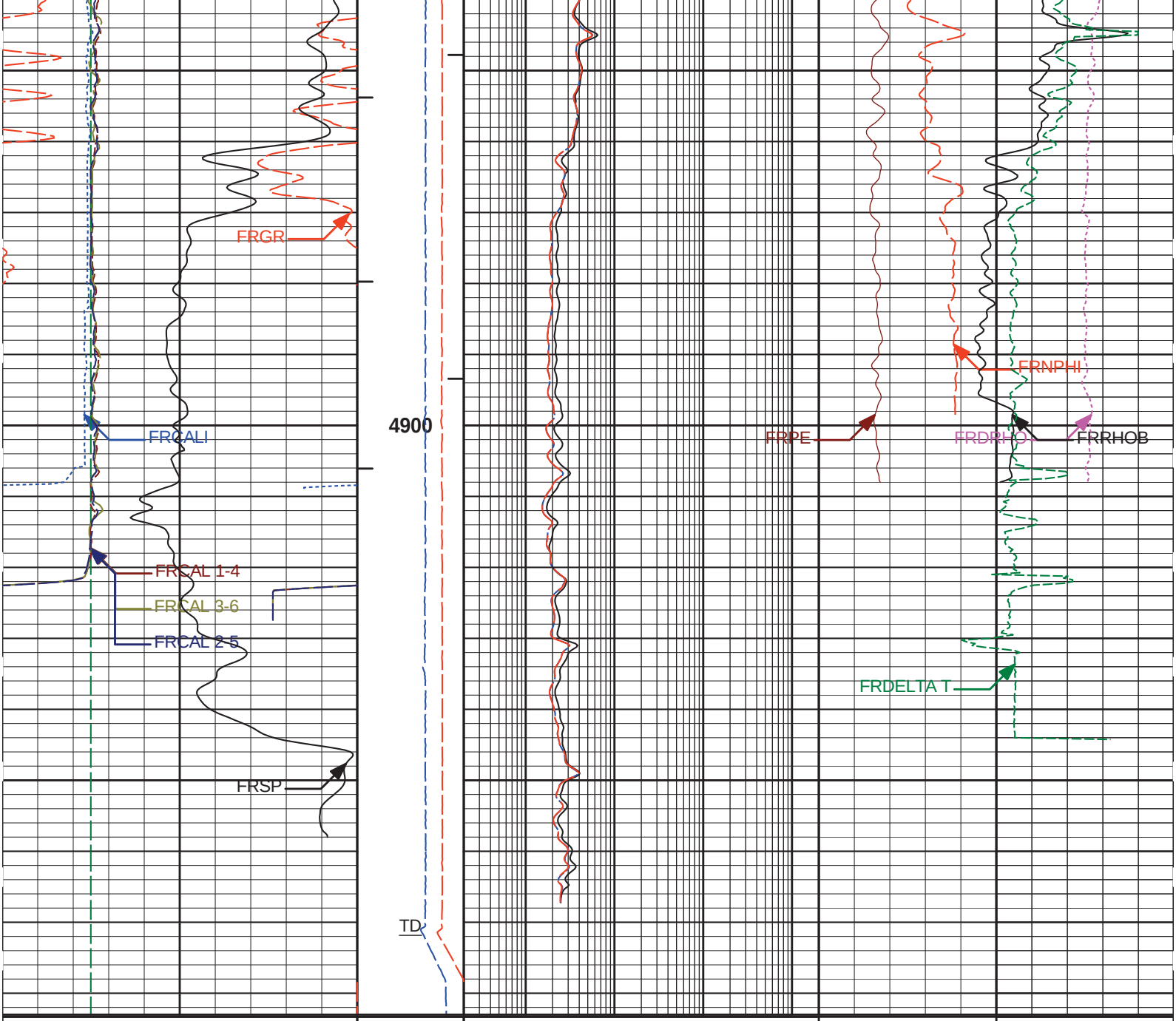

SP
RT10
RT60
RT90
3800
BS
CH_TENS
TENS
3900
GR
NPHI
CALI
DRHO
PE
RHOB


CAL 1-4
CAL 3-6
CAL 2-5
SP
4000
RT10
RT60
RT90
DELTA T
BS
CH TENS
TENS
4100
GR
NPHI


CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
BS
GR
4200
4300
4400
RT10
RT60
RT90
CH TENS
TENS
PE
RHOB
DPHQ
DELTA T


4400
4500
4600
CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
BS
CH TENS
TENS
RT10
RT60
RT90
NPHI
DPHO
PE
RHOB
DELTA T


GR
CALI
CAL 1-4
CAL 3-6
CAL 2-5
SP
BS
4700
4800
RT10
RT60
RT90
CH.TENS
TENS
NPHI
DPHO
PE
RHOB
DELTAT



SP	1 : 240	0.2 RT10 2K
-]10[+	ft	ohmm
6 BS 16	TENS	0.2 RT60 2K
inches	10000 0	ohmm
6 CALI 16	CH TENS	0.2 RT90 2K
inches	10000 0	ohmm
0 GR 150	AHV	
gapi		
6 CAL 1-4 16	BHV	
inches		
6 CAL 3-6 16		
inches		
6 CAL 2-5 16		
inches		

	-0.25 DRHO 0.25
	g/cc
1.65 RHOB 2.65	
g/cc	
60 NPHI 0	
%	
0 PE 20	
175 DELTA T 75	
uspf	

HALLIBURTON

Plot Time: 25-Mar-13 02:44:14

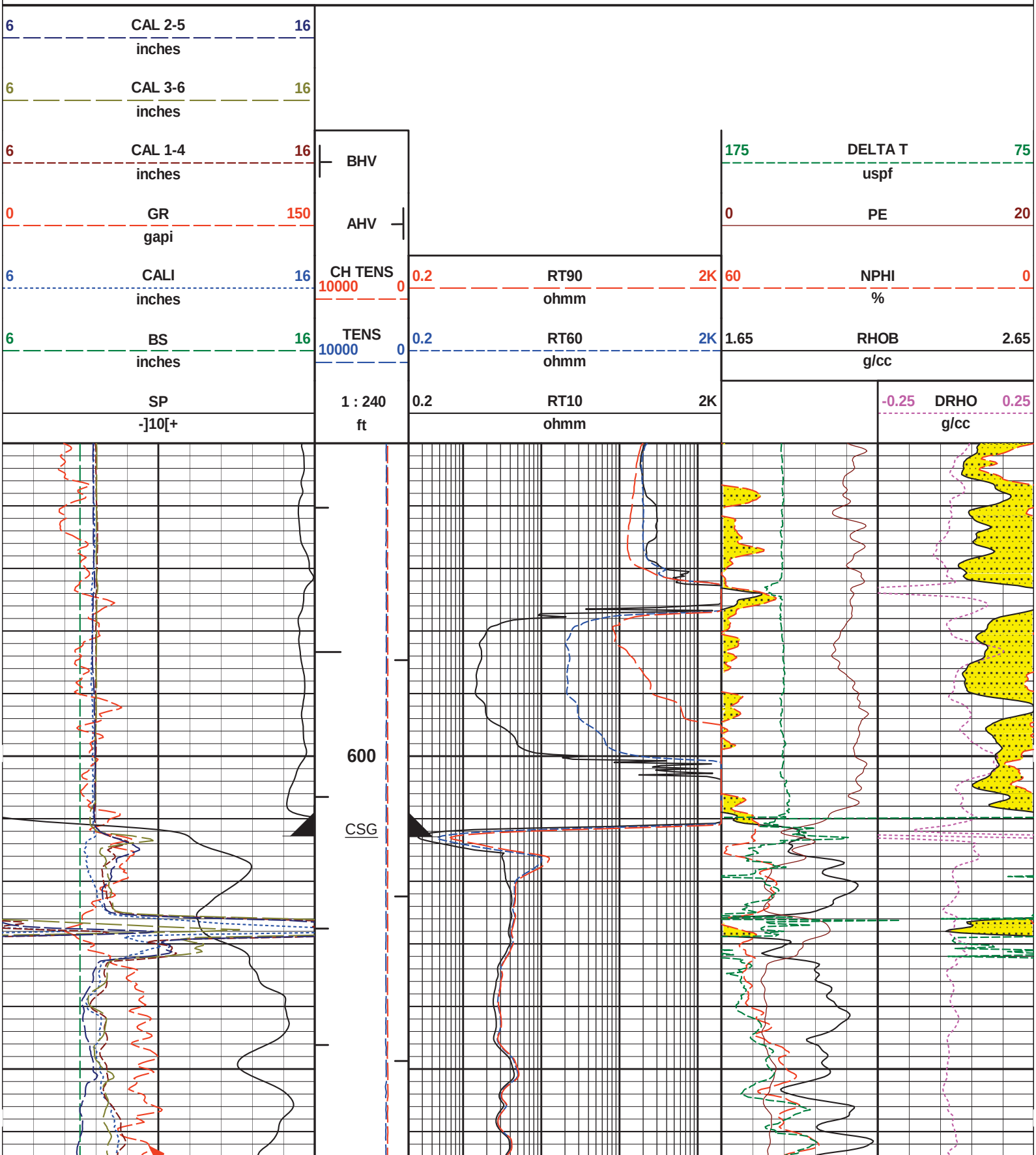
Plot Range: 550 ft to 1005.5 ft

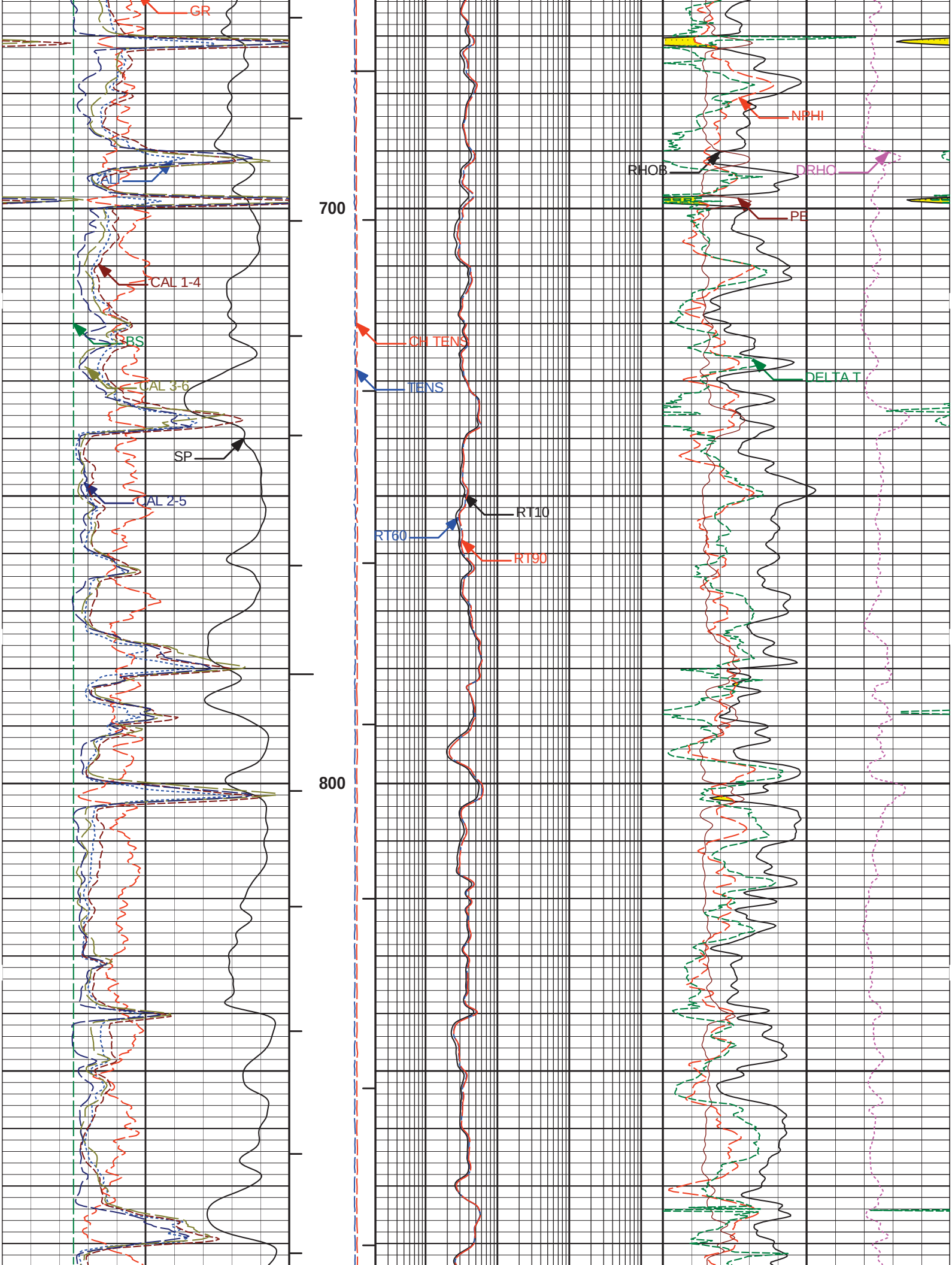
Data: PIACENTINE 2-27\Well Based\DAQ-0001-003.01\

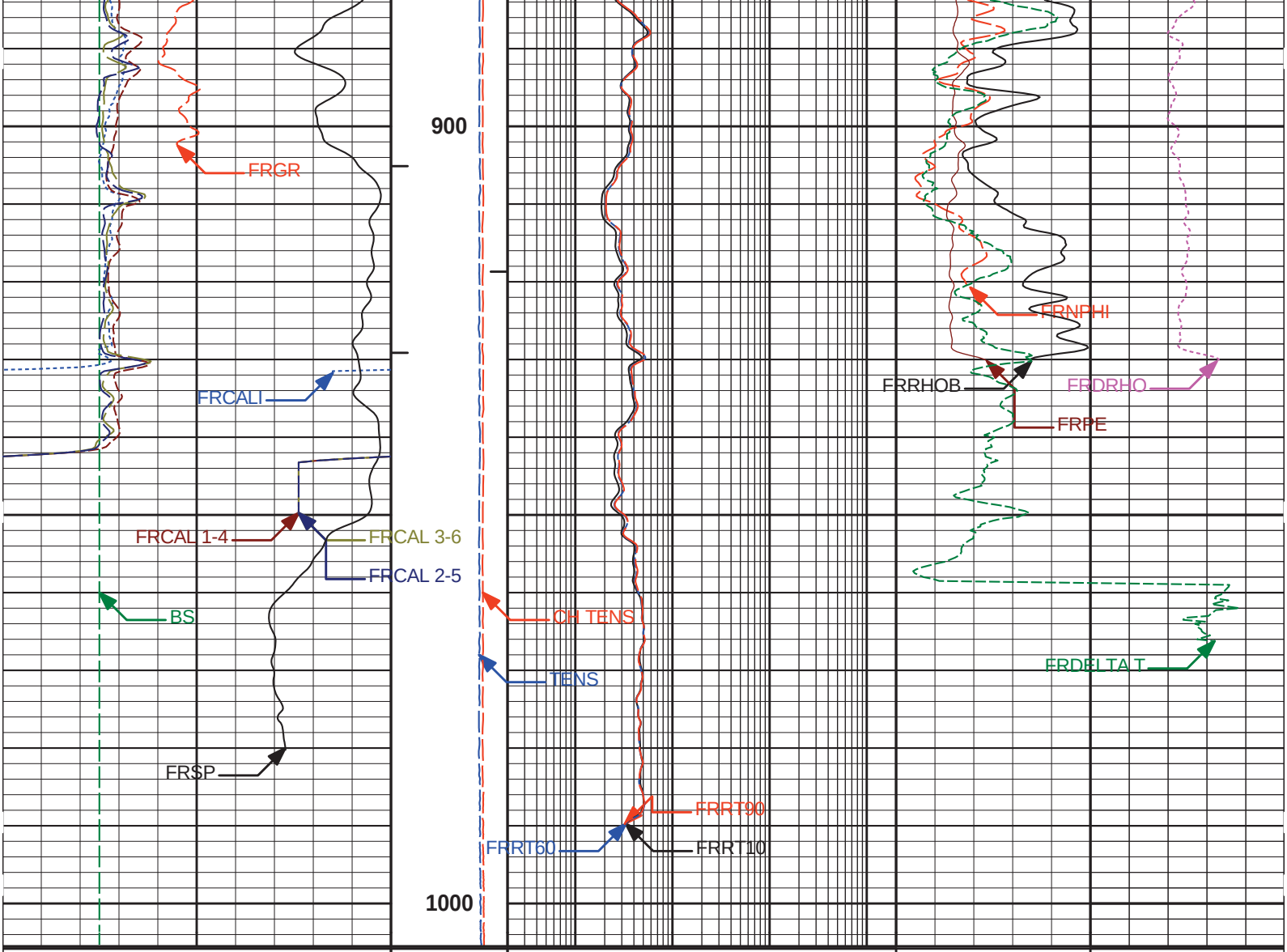
Plot File: \\QC_PRINT\PGE_5IN REPEAT

REPEAT PASS

5" = 100'




GR
ALI
CAL 1-4
BS
CAL 3-6
SP
CAL 2-5
700
800
CH TENS
TENS
RT10
RT60
RT90
NPHI
RHOB
DRHO
PE
DELTA T



SP	1 : 240	0.2 RT10 2K		-0.25 DRHO 0.25
-]10[+	ft	ohmm		g/cc
6 BS 16	TENS 10000 0	0.2 RT60 2K	1.65 RHOB 2.65	
inches		ohmm	g/cc	
6 CALI 16	CH TENS 10000 0	0.2 RT90 2K	60 NPHI 0	
inches		ohmm	%	
0 GR 150	AHV		0 PE 20	
gapi				
6 CAL 1-4 16	BHV		175 DELTA T 75	
inches			uspf	
6 CAL 3-6 16				
inches				
6 CAL 2-5 16				
inches				

HALLIBURTON

PARAMETERS REPORT

Depth (ft)	Tool Name	Mnemonic	Description	Value	Units
TOP					

SHARED	BS	Bit Size	8.500	in
SHARED	UBS	Use Bit Size instead of Caliper for all applications.	No	
SHARED	MDBS	Mud Base	Water	
SHARED	MDWT	Borehole Fluid Weight	10.200	ppg
SHARED	WAGT	Weighting Agent	Barite	
SHARED	BSAL	Borehole salinity	0.00	ppm
SHARED	FSAL	Formation Salinity NaCl	0.00	ppm
SHARED	KPCT	Percent K in Mud by Weight?	0.00	%
SHARED	RMUD	Mud Resistivity	3.400	ohmm
SHARED	TRM	Temperature of Mud	72.0	degF
SHARED	CSD	Logging Interval is Cased?	No	
SHARED	ICOD	AHV Casing OD	5.500	in
SHARED	ST	Surface Temperature	75.0	degF
SHARED	TD	Total Well Depth	4972.00	ft
SHARED	BHT	Bottom Hole Temperature	133.0	degF
SHARED	AZTM	High Res Z Accelerometer Master Tool	GTET	
SHARED	TEMM	Temperature Master Tool	NONE	
SHARED	BHSM	Borehole Size Master Tool	ICT	
Rwa / CrossPlot	XPOK	Process Crossplot?	Yes	
Rwa / CrossPlot	FCHO	Select Source of F	Automatic	
Rwa / CrossPlot	AFAC	Archie A factor	0.6200	
Rwa / CrossPlot	MFAC	Archie M factor	2.1500	
Rwa / CrossPlot	RMFR	Rmf Reference	2.00	ohmm
Rwa / CrossPlot	TMFR	Rmf Ref Temp	75.00	degF
Rwa / CrossPlot	RWA	Resistivity of Formation Water	0.05	ohmm
Rwa / CrossPlot	ADP	Use Air Porosity to calculate CrossplotPhi	No	
GTET	GROK	Process Gamma Ray?	Yes	
GTET	GRSO	Gamma Tool Standoff	0.000	in
GTET	GEOK	Process Gamma Ray EVR?	No	
GTET	TPOS	Tool Position for Gamma Ray Tools.	Eccentered	
CSNG	CGOK	Process CSNG Data?	Yes	
CSNG	CENT	Is Tool Centralized?	No	
CSNG	GBOK	Gamma Enviromental Corrections?	Yes	
CSNG	BARF	Barite Correction Factor	1.00	
CSNG	ORDG	Use Fixed Gain	No	
CSNG	ORDO	Use Fixed Offset	No	
CSNG	ORDR	Use Fixed Resolution Degradation Factor	No	
DSNT	DNOK	Process DSN?	Yes	
DSNT	DEOK	Process DSN EVR?	No	
DSNT	NLIT	Neutron Lithology	Sandstone	
DSNT	DNSO	DSN Standoff - 0.25 in (6.35 mm) Recommended	0.250	in
DSNT	DNTP	Temperature Correction Type	None	
DSNT	DPRS	DSN Pressure Correction Type	None	
DSNT	SHCO	View More Correction Options	No	
DSNT	UTVD	Use TVD for Gradient Corrections?	No	
DSNT	LHWT	Logging Horizontal Water Tank?	No	
DSNT	UCLA	Classic Neutron Parameter utilized?	Yes	
SDLT	CLOK	Process Caliper Outputs?	Yes	
SDLT Pad	DNOK	Process Density?	Yes	
SDLT Pad	DNOK	Process Density EVR?	No	
SDLT Pad	CB	Logging Calibration Blocks?	No	

SDLT Pad	SPVT	SDLT Pad Temperature Valid?	Yes	
SDLT Pad	DTWN	Disable temperature warning	No	
SDLT Pad	DMA	Formation Density Matrix	2.650	g/cc
SDLT Pad	DFL	Formation Density Fluid	1.000	g/cc
Microlog Pad	MLOK	Process MicroLog Outputs?	Yes	
ICT	CLOK	Process Caliper Outputs?	Yes	
ICT	DARM	Disable Caliper Arm	No	
ICT	ATDS	Arm To Disable	0	
ICT	REPM	Method to replace arm?	Caliper Average	
ICT	ARMV	Diameter to use for disabled arm	0.00	in
ICT	DARM	Disable Second Caliper Arm	No	
ICT	ATDS	Second Arm To Disable	0	
ICT	REPM	Method to replace second arm?	Caliper Average	
ICT	ARMV	Diameter to use for second disabled arm	0.00	in
ICT	CL1O	Radius 1 Offset	0.0	in
ICT	CL2O	Radius 2 Offset	0.0	in
ICT	CL3O	Radius 3 Offset	0.0	in
ICT	CL4O	Radius 4 Offset	0.0	in
ICT	CL5O	Radius 5 Offset	0.0	in
ICT	CL6O	Radius 6 Offset	0.0	in
ICT	BHVC	Radius type for borehole volume calcuations	Elliptical	
BSAT	MBOK	Compute BCAS Results?	Yes	
BSAT	FLLO	Frequency Filter Low Pass Value?	5000	Hz
BSAT	FLHI	Frequency Filter High Pass Value?	27000	Hz
BSAT	DTFL	Delta -T Fluid	189.00	uspf
BSAT	DTMT	Delta -T Matrix Type	Sandstone 55.5	
BSAT	DTSH	Delta -T Shale	100.00	uspf
BSAT	SPEQ	Acoustic Porosity Equation	Wylie	
ACRt Sonde	RTOK	Process ACRt?	Yes	
ACRt Sonde	MNSO	Minimum Tool Standoff	1.50	in
ACRt Sonde	TCS1	Temperature Correction Source	FP Lwr & FP Upr	
ACRt Sonde	TPOS	Tool Position	Free Hanging	
ACRt Sonde	RMOP	Rmud Source	Mud Cell	
ACRt Sonde	RMIN	Minimum Resistivity for MAP	0.20	ohmm
ACRt Sonde	RMIN	Maximum Resistivity for MAP	200.00	ohmm
ACRt Sonde	THQY	Threshold Quality	0.50	
ACRt Sonde	MRFX	Fixed mud resistivity	2000	ohmm

BOTTOM

HALLIBURTON

CALIBRATION REPORT

SURFACE TENSION SHOP CALIBRATION

Tool Name: Depth Panel - 00000069 **Reference Calibration Date:** 20-Mar-13 12:51:35

Engineer: D. SANDOVAL **Calibration Date:** 24-Mar-13 22:17:58

Software Version: WL INSITE R3.8.4 (Build 5) **Calibration Version:** 1

SURFACE TENSION LOAD CELL

Measurement	Load Cell Value	Measurement	Calibrated	Units
Low	10720.78	4.34	0.00	lbs
High	17530.23	7842.26	7840.00	lbs

DOWNHOLE TENSION SHOP CALIBRATION

Tool Name:	**RWCH - 11732196**	**Reference Calibration Date:**	**23-Mar-13 05:47:16**
Engineer:	**D. SANDOVAL**	**Calibration Date:**	**24-Mar-13 22:19:22**
Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**

DOWNHOLE LOAD CELL

Measurement	Tool Value	Measurement	Calibrated	Units
Low	-689.04	-13.18	0.00	lbs
High	6245.21	1967.61	1860.00	lbs

NATURAL GAMMA RAY TOOL SHOP CALIBRATION

Tool Name:	**GTET - 11534457**	**Reference Calibration Date:**	**20-Feb-13 09:11:37**
Engineer:	**N. DELANO**	**Calibration Date:**	**19-Mar-13 18:52:50**
Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**

Calibrator Source S/N: TB41
Calibrator API Reference:236.00 api
Equivalent Calibrator API Reference:240.1 api

Measurement	Measured	Calibrated	Units
Background	49.2	49.3	api
Background + Calibrator	288.5	289.5	api
Calibrator	239.3	240.1	api

NATURAL GAMMA RAY TOOL FIELD CALIBRATION

Tool Name:	**GTET - 11534457**	**Reference Calibration Date:**	**19-Mar-13 18:52:50**
Engineer:	**D. SANDOVAL**	**Calibration Date:**	**24-Mar-13 09:38:51**
Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**

Calibrator Source S/N: TB41
Calibrator API Reference:236.00 api
Equivalent Calibrator API Reference:240.1 api

Field Verification	Shop	Field	Units
Background	49.3	32.4	api
Background + Calibrator	289.5	268.6	api
Calibrator	240.1	236.2	api

Shop	Field	Difference	Tolerance
240.1	236.2	3.9	+/- 9.00

CSNG-FS SHOP CALIBRATION

Tool Name:	**CSNG - 11439724**	**Reference Calibration Date:**	**05-Mar-13 02:36:46**
Engineer:	**D. SANDOVAL**	**Calibration Date:**	**05-Mar-13 03:01:31**
Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**
Source SN:	**TB2121**		

TITANIUM CASE	Measured	Calibrated	Units
60 KEV Peak Channel #	48.0	48.0	Channel #
239 KEV Peak Channel #	23.4	23.5	Channel #
583 KEV Peak Channel #	52.6	53.1	Channel #
2614 KEV Peak Channel #	217.9	219.4	Channel #
Calibrate Temperature	78.3	84.1	degF

Pass/Fail Summary	Centroid

239 KEV Peak	Passed
583 KEV Peak	Passed
2614 KEV Peak	Passed

Blanket Reference Value: 216.00 API
Calibrator Value: 245.3 API

	Counts	Units	Measured	Calibrated	Units
Thorium Blanket	1399.6	CPS	272.7	273.4	API
Background	143.9	CPS	27.4	28.1	API

Gamma Ray Gain: 0.98
Expected Gain Range: 0.85 - 1.15
Gamma Gain Check: Passed

CSNG-FS FIELD CALIBRATION

Tool Name: CSNG - 11439724
Reference Calibration Date: 05-Mar-13 03:01:31
Engineer: D. SANDOVAL
Calibration Date: 24-Mar-13 09:36:26
Software Version: WL INSITE R3.8.4 (Build 5)
Calibration Version: 1
Source SN:

TITANIUM CASE	Shop	Field	Units
60 KEV Peak Channel #	48.0	48.0	Channel #
239 KEV Peak Channel #	23.5	23.3	Channel #
583 KEV Peak Channel #	53.1	52.5	Channel #
2614 KEV Peak Channel #	219.4	217.0	Channel #
Calibrate Temperature	84.1	104.5	degF

Pass/Fail Summary	Centroid
239 KEV Peak	Passed
583 KEV Peak	Passed
2614 KEV Peak	Passed

Blanket Reference Value: 216.00 API
Calibrator Value: 245.3 API

	Counts	Units	Measured	Calibrated	Units
Thorium Blanket	1476.0	CPS	273.4	271.7	API
Background	143.4	CPS	28.1	26.4	API

Gamma Ray Gain: 0.93
Expected Gain Range: 0.85 - 1.15
Gamma Gain Check: Passed

DUAL SPACED NEUTRON SHOP CALIBRATION

Tool Name: DSNT - 10971182
Reference Calibration Date: 20-Feb-13 10:26:43
Engineer: N. DELANO
Calibration Date: 19-Mar-13 21:35:49
Software Version: WL INSITE R3.8.4 (Build 5)
Calibration Version: 1

Logging Source S/N: DSN-306
Tank Serial Number: 105014
Reference value assigned to Tank: 54.500
Snow Block S/N: TRUCK 69

Calibration Tank Water Temperature: 85 degF

Min. Tool Housing Outside Diameter: 3.625 in

CALIBRATION CONSTANTS			
Measurement	Prev. Value	New Value	Control Limit On New Value
Gain:	0.970	0.972	0.900 - 1.100

WATER TANK SUMMARY (Horizontal Water Tank)				
Measurement	Current Reading (Previous Coef.)	Calibrated (New Coef.)	Change	Control Limit On Change
Porosity (decp):	0.2262	0.2267	0.0005	+/- 0.0020
Calibrated Ratio:	10.24	10.26	0.017	+/- 0.050

VERIFIER		
Measurement	Value	Control Limit
Snow-Block Porosity (decp):	0.0700	0.02000 - 0.09000

PASS/FAIL SUMMARY	
Background Check:	Passed
Gain-Range Check:	Passed
Snow-Block Check:	Passed

DUAL SPACED NEUTRON FIELD CALIBRATION

Tool Name: DSNT - 10971182 **Reference Calibration Date:** 19-Mar-13 21:35:49

Engineer: D. SANDOVAL **Calibration Date:** 24-Mar-13 09:46:13

Software Version: WL INSITE R3.8.4 (Build 5) **Calibration Version:** 1

Logging Source S/N: DSN-306

Snow Block S/N: TRUCK 69

NEUTRON FIELD-CHECK SUMMARY				
	Shop	Field	Difference	Control Limit On Change
Snow-Block Porosity (decp):	0.0700	0.0676	-0.0024	+/- 0.0150

PASS/FAIL SUMMARY	
Block Change Check:	Passed
Snow Block Stat Check:	Passed
Temperature Check:	Passed

DENSITY CALIPER SHOP CALIBRATION

Tool Name: SDLT - 11014278 **Reference Calibration Date:** 22-Mar-13 03:52:40

Engineer: A. EVERSON **Calibration Date:** 22-Mar-13 03:59:17

Software Version: WL INSITE R3.8.4 (Build 5) **Calibration Version:** 1

Host Tool Name: DSNT - 10971182

CALIBRATION COEFFICIENTS			
Measurement	Previous Value	New Value	Control Limit On New Value
Pad Offset	-1864.40	-1863.53	-7000.00 - -1000.00
Pad Gain	0.0003746	0.0003745	0.000200 - 0.000600
Arm Offset	-1380.79	-1461.64	-5000.00 - 3000.00
Arm Gain	0.0005103	0.0005156	0.000300 - 0.000700
Arm Power	-0.000005143	-0.000005426	-0.000010000 - 0.000010000

The ring diameter is computed from: DIAMETER = PAD EXTENSION + ARM EXTENSION + TOOL DIAMETER

Tool Diameter: 4.50 in

CALIBRATION RINGS

Measurement	Current Reading (Previous Coeff.)	Calibrated (New Coeff.)	Change	Control Limit On New Value
PAD EXTENSION:				
Small Ring (in)	2.00	2.00	0.00	+/- 0.20
Medium Ring (in)	3.75	3.75	0.00	+/- 0.20
RING DIAMETER:				
Small Ring (in)	6.52	6.50	-0.02	+/- 0.20
Medium Ring (in)	8.26	8.25	-0.01	+/- 0.20
Large Ring (in)	15.00	15.00	0.00	+/- 0.20

PASS/FAIL SUMMARY

Calibration-Coefficients Range Check:	Passed
Ring-Measurement Check:	Passed

PASS/FAIL SUMMARY

Calibration-Coefficients Range Check:	Passed

SDLT CALIPER FIELD CALIBRATION

Tool Name: SDLT - 11014278 **Reference Calibration Date:** 22-Mar-13 03:59:17

Engineer: D. SANDOVAL **Calibration Date:** 24-Mar-13 09:24:34

Software Version: WL INSITE R3.8.4 (Build 5) **Calibration Version:** 1

MEASURED CALIPER VALUES

Measurement	Shop	Field	Change	Control Limit On New Value
Pad Extension	3.75	3.73	-0.02	+/- 0.10
Ring Diameter	8.25	8.36	0.11	+/- 0.15

PASS/FAIL SUMMARY

Pad Extension Check:	Passed
Diameter Check:	Passed

SPECTRAL DENSITY SHOP CALIBRATION

Tool Name: SDLT Pad - 10746645 **Reference Calibration Date:** 19-Mar-13 13:22:21

Engineer: N. DELANO **Calibration Date:** 19-Mar-13 13:45:47

Software Version: WL INSITE R3.8.4 (Build 5) **Calibration Version:** 1

Logging Source S/N: 5492GW

Aluminum Block S/N: 11342493	Density: 2.607g/cc	Pe: 3.100
Magnesium Block S/N: 10743529	Density: 1.680g/cc	Pe: 2.594

DENSITY CALIBRATION SUMMARY

Measurement	Previous Value	New Value	Control Limit
Near Bar Gain	1.0665	1.0192	0.90 - 1.10
Near Dens Gain	1.0257	0.9973	0.90 - 1.10
Near Peak Gain	1.0116	0.9537	0.90 - 1.10
Near Lith Gain	0.9568	0.9249	0.90 - 1.10
Far Bar Gain	1.0175	1.0107	0.90 - 1.10
Far Dens Gain	0.9985	0.9965	0.90 - 1.10
Far Peak Gain	0.9897	0.9858	0.90 - 1.10
Far Lith Gain	0.9643	0.9603	0.90 - 1.10
Near Bar Offset	-0.6460	-0.2003	NONE

Near Dens Offset	-0.2627	-0.0038	NONE
Near Peak Offset	-0.0856	0.4095	NONE
Near Lith Offset	0.4056	0.6769	NONE
Far Bar Offset	-0.2198	-0.1594	NONE
Far Dens Offset	-0.0346	-0.0188	NONE
Far Peak Offset	0.0451	0.0765	NONE
Far Lith Offset	0.2100	0.2420	NONE

Near Bar Background	852.97	852.03	700 - 1450
Near Dens Background	278.94	278.61	230 - 480
Near Peak Background	119.58	120.42	100 - 210
Near Lith Background	149.67	148.59	125 - 260
Far Bar Background	478.45	478.64	450 - 900
Far Dens Background	189.14	188.16	175 - 345
Far Peak Background	74.28	75.97	70 - 140
Far Lith Background	76.65	77.79	75 - 145

CALIBRATION BLOCK SUMMARY

Measurement	Current Reading (Previous Coef)	Calibrated (New Coef)	Change	Control Limit On Change
MAGNESIUM				
Density (g/cc)	1.678	1.679	0.001	+/- 0.015
Pe	2.565	2.568	0.003	+/- 0.150
ALUMINUM				
Density (g/cc)	2.597	2.606	0.009	+/- 0.01500
Pe	3.061	3.077	0.016	+/- 0.150

TOOL SUMMARY

Measurement	Near Detector		Far Detector	
	Value	Control Limits	Value	Control Limits
QUALITY				
Background	-0.0009	+/- 0.0110	0.0010	+/- 0.0140
Magnesium Block	-0.0005	+/- 0.0110	0.0001	+/- 0.0140
Aluminum Block	0.0001	+/- 0.0110	-0.0006	+/- 0.0140
Resolution	9.73	6.00 - 11.50	9.34	6.00 - 11.50
Internal Verifier(B+D+P+L)	1400	1200 - 2700	821	800 - 1700

PASS/FAIL SUMMARY

Background Quality Check:	Passed
Background Range Check:	Passed
Background Resolution Check:	Passed
Background Verification Check:	Passed
Magnesium Quality Check:	Passed
Aluminum Quality Check:	Passed
Gains Check:	Passed
Changes in Calibration Blocks:	Passed

SPECTRAL DENSITY FIELD CHECK

Tool Name: SDLT Pad - 10746645
Reference Calibration Date: 19-Mar-13 13:45:47
Engineer: D. SANDOVAL
Calibration Date: 24-Mar-13 09:21:58
Software Version: WL INSITE R3.8.4 (Build 5)
Calibration Version: 1

Pad Temperature: 58.1 degF

DENSITY FIELD CALIBRATION SUMMARY				
Measurement	Shop	Field	Change	Control Limit +/-
Near (B+D+P+L) cps	1399.648	1396.682	-2.966	15.109
Far (B+D+P+L) cps	820.564	821.299	0.735	15.803
Near Resolution	9.73	9.84	0.110	0.50
Far Resolution	9.34	9.52	0.180	1.00

PASS/FAIL SUMMARY	
Bkg Quality Check:	Passed
Bkg Resolution Check:	Passed
Bkg Verification Check:	Passed

ICT SHOP CALIBRATION

Tool Name: ICT - 11437412 **Reference Calibration Date:** 08-Feb-13 16:55:27

Engineer: G. ROUSSEAU **Calibration Date:** 24-Mar-13 09:12:44

Software Version: WL INSITE R3.8.4 (Build 5) **Calibration Version:** 1

CALIPERS AND RINGS			
Ring	Measured	Calibrated	Units
CALIPER 1:			
Small Ring	3.34	3.65	in
Medium Ring	7.91	8.00	in
Large Ring	14.74	15.00	in
X-Large Ring	20.65	21.00	in
CALIPER 2:			
Small Ring	4.10	3.65	in
Medium Ring	8.63	8.00	in
Large Ring	15.37	15.00	in
X-Large Ring	21.19	21.00	in
CALIPER 3:			
Small Ring	3.83	3.65	in
Medium Ring	8.45	8.00	in
Large Ring	15.65	15.00	in
X-Large Ring	21.07	21.00	in
CALIPER 4:			
Small Ring	3.94	3.65	in
Medium Ring	8.31	8.00	in
Large Ring	15.31	15.00	in
X-Large Ring	21.03	21.00	in
CALIPER 5:			
Small Ring	3.96	3.65	in
Medium Ring	8.41	8.00	in
Large Ring	15.34	15.00	in
X-Large Ring	21.12	21.00	in
CALIPER 6:			
Small Ring	4.12	3.65	in
Medium Ring	8.76	8.00	in
Large Ring	15.72	15.00	in
X-Large Ring	21.39	21.00	in

ICT FIELD CALIBRATION

Tool Name: ICT - 11437412 **Reference Calibration Date:** 24-Mar-13 09:12:44

Engineer: G. ROUSSEAU **Calibration Date:** 24-Mar-13 09:15:18

Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**

CALIPERS

Caliper	Shop	Field	Units
Caliper 1	8.00	8.01	in
Caliper 2	8.00	8.00	in
Caliper 3	8.00	8.02	in
Caliper 4	8.00	7.99	in
Caliper 5	8.00	7.96	in
Caliper 6	8.00	7.98	in

BSAT FIELD CASING CHECK

Tool Name:	**BSAT - 10939059**	**Calibration Date:**	**24-Mar-13 22:23:34**
Engineer:	**D. SANDOVAL**		
Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**

Pre-Log Check	Check Depth	Shop	Field	Difference	Tolerance	Units
Delta-T Compensated	186.33	57.00	56.02	0.9800	1.00	uspf

ARRAY COMPENSATED TRUE RESISTIVITY SHOP CALIBRATION

Tool Name:	**ACRt Sonde - 10809609**	**Reference Calibration Date:**	**19-Mar-13 18:19:18**
Engineer:	**N. DELANO**	**Calibration Date:**	**19-Mar-13 18:27:14**
Software Version:	**WL INSITE R3.8.4 (Build 5)**	**Calibration Version:**	**1**
Host Tool Name:	**ACRt Instrument - 10832951**		

TYPICAL GAIN RANGE

Subarray	R12KHz			R36KHz			R72KHz		
	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper
A1 (80")	0.95	1.02	1.05	0.95	1.02	1.05	0.95	1.01	1.05
A2 (50")	0.95	1.02	1.05	0.95	1.02	1.05	0.95	1.01	1.05
A3 (29")	0.95	1.03	1.05	0.95	1.03	1.05	0.95	1.01	1.05
A4 (17")	0.95	1.01	1.05	0.95	1.01	1.05	0.95	0.99	1.05
A5 (10")	N/A	N/A	N/A	0.95	1.01	1.05	0.95	1.00	1.05
A6 (6")	N/A	N/A	N/A	0.95	1.00	1.05	0.95	0.99	1.05

TYPICAL SONDE OFFSET RANGE

Subarray	R12KHz			R36KHz			R72KHz		
	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper	Lower	(mmho/m)	Upper
A1 (80")	-5	-0.23	2	-6	-3.63	-2	-8	-4.83	-2
A2 (50")	-7	-1.63	0	-7	-3.50	0	-7	-4.58	0
A3 (29")	-27	-12.35	-9	-9	-3.76	-3	-7	-2.99	-1
A4 (17")	-180	-99.79	-60	-45	-31.52	-15	-39	-24.86	-13
A5 (10")	N/A	N/A	N/A	-150	-97.12	-50	-80	-46.43	-10
A6 (6")	N/A	N/A	N/A	175	253.20	525	90	129.65	270

TRANSMITTER CURRENT GAIN

Signal	Lower	R	Upper
12K	0.6	0.81	1.3
36K	1.0	1.26	2.0
72K	1.0	1.60	2.0

R-MUD VERIFICATION

Signal	Lower (ohm-m)	Measured (ohm-m)	Upper (ohm-m)
Mud Cell	0.95	1.00	1.05

PASS/FAIL SUMMARY

GAIN RANGE CHK	PASS

SONDE OFFSET RANGE CHK	PASS
Tx CURRENT GAIN	PASS
Rmud VERIFICATION	PASS

TOOL OK TO LOG

CALIBRATION SUMMARY

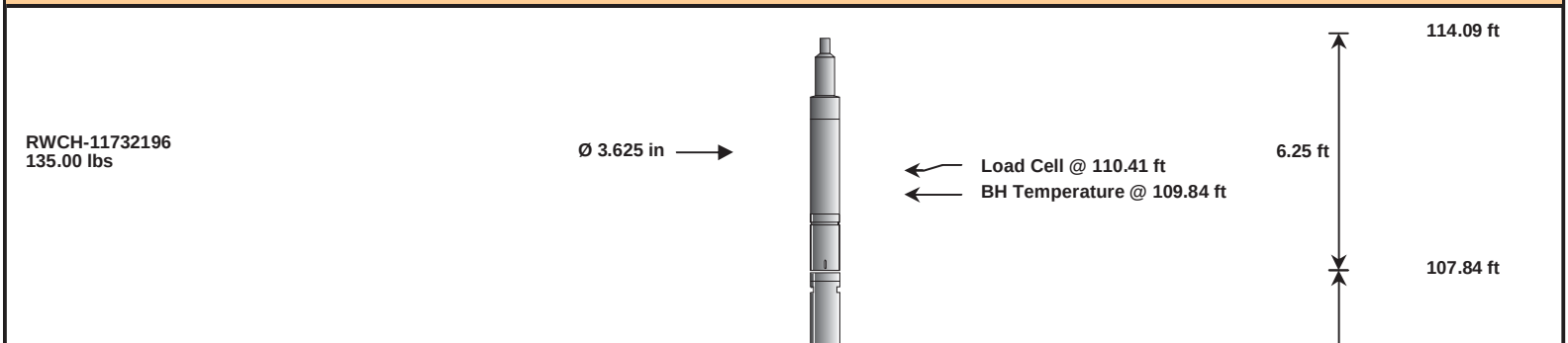
Sensor	Shop	Field	Post	Difference	Tolerance	Units
Depth Panel-00000069						
Tension Zero	0.00	----------	----------	0.00	----------	lbs
Tension Cal	7840.00	----------	----------	0.00	----------	lbs
RWCH-11732196						
DH Tension Zero	0.00	----------	----------	0.00	----------	lbs
DH Tension Cal	1860.00	----------	----------	0.00	----------	lbs
GTET-11534457						
Gamma Ray Calibrator	240.1	236.2	----------	3.9	+/- 9.00	api
CSNG-11439724						
60 KEV Peak Channel #	48.0	48.0	----------	0.0	----------	Channel #
239 KEV Peak Channel #	23.5	23.3	----------	0.2	----------	Channel #
583 KEV Peak Channel #	53.1	52.5	----------	0.6	----------	Channel #
2614 KEV Peak Channel #	219.4	217.0	----------	2.4	----------	Channel #
DSNT-10971182						
Snow-Block Porosity	0.0700	0.0676	----------	0.0024	+/- 0.0150	decp
SDLT-11014278						
Pad Extension	3.75	3.73	----------	0.02	+/-0.10	in
Ring Diameter	8.25	8.36	----------	-0.11	+/-0.15	in
SDLT Pad-10746645						
Near(B+D+P+L)	1399.648	1396.682	----------	2.966	+/-15.109	cps
Far(B+D+P+L)	820.564	821.299	----------	-0.735	+/-15.803	cps
ICT-11437412						
Caliper 1	8.00	8.01	----------	-0.01	+/-0.25	in
Caliper 2	8.00	8.00	----------	0.00	+/-0.25	in
Caliper 3	8.00	8.02	----------	-0.02	+/-0.25	in
Caliper 4	8.00	7.99	----------	0.01	+/-0.25	in
Caliper 5	8.00	7.96	----------	0.04	+/-0.25	in
Caliper 6	8.00	7.98	----------	0.02	+/-0.25	in
ACRt Sonde-10809609						
Mud Cell	1.00	----------	----------	0.00	----------	ohm-m

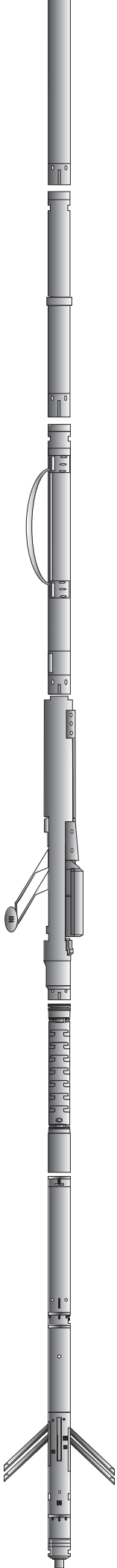
Date: PIACENTINE 2-27\0001 TC_ICT_PSAT_CSNG_pge\IDLE Date: 25 Mar 12 02:07:24

HALLIBURTON

TOOL STRING DIAGRAM REPORT

Description	Overbody Description	O.D.	Diagram	Sensors @ Delays	Length	Accumulated Length





GTET-11534457
165.00 lbs

Ø 3.625 in

8.52 ft

GammaRay @ 101.78 ft

99.32 ft

UnivWearRing3.6-00001052
5.00 lbs

CSNG-11439724
114.00 lbs

Ø 4.200 in*
Ø 3.625 in

8.17 ft

CSNG @ 93.69 ft

91.15 ft

DSN Decentralizer-10971182
6.60 lbs

DSNT-10971182
174.00 lbs

Ø 5.000 in*
Ø 3.625 in

9.69 ft

DSN Far @ 84.22 ft
DSN Near @ 83.47 ft

81.47 ft

SDLT-11014278
360.00 lbs

Ø 4.500 in

10.81 ft

SDLT Pad-10746645
65.00 lbs

Microlog Pad-11014278
8.00 lbs

Ø 4.750 in*
Ø 4.750 in*

Microlog @ 73.65 ft
SDL Caliper @ 73.47 ft
SDL @ 73.46 ft

70.65 ft

Flex Joint - Pressure Comp-11259764
140.00 lbs

Ø 3.625 in

5.97 ft

64.68 ft

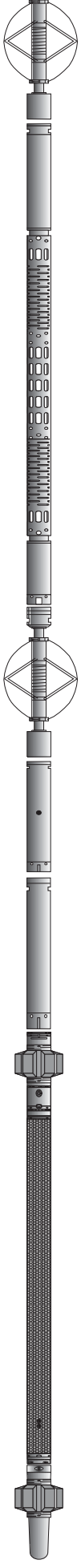
ICT-11437412
330.00 lbs

Ø 3.625 in

12.83 ft

ICT Caliper @ 54.64 ft

51.86 ft



Mnemonic	Tool Name	Serial Number	Weight (lbs)	Length (ft)	Accumulated Length (ft)	Max.Log. Speed (fpm)
RWCH	Releasable Wireline Cable Head	11732196	135.00	6.25	107.84	300.00
GTET	Gamma Telemetry Tool	11534457	165.00	8.52	99.32	60.00

CSNG	Compensated Spectral Natural Gamma	11439724	114.00	8.17		91.15	15.00
UWR3P6	Universal Wear Ring 3 5-8 inch	00001052	5.00	0.35	*	95.23	300.00
DSNT	Dual Spaced Neutron	10971182	174.00	9.69		81.47	60.00
DCNT	DSN Decentralizer	10971182	6.60	5.13	*	84.80	300.00
SDLT	Spectral Density Tool	11014278	360.00	10.81		70.65	60.00
MICP	Microlog Pad	11014278	8.00	1.00	*	73.15	60.00
SDLP	Density Insite Pad	10746645	65.00	2.55	*	72.86	60.00
FLEX	Flex Joint - Pressure Compensated	11259764	140.00	5.97		64.68	300.00
ICT	Six Independent Arm Caliper	11437412	330.00	12.83		51.86	30.00
CENT-A	Inline Centralizer	11574685	50.00	5.00		46.86	300.00
BSAT	Borehole Sonic Array Tool	10939059	300.00	15.77		31.08	60.00
CENT-A	Inline Centralizer	11702778	50.00	5.00		26.08	300.00
SP	Analog Logiq SP Sub	11575136	60.00	3.73		22.35	300.00
ACRt	Array Compensated True Resistivity Instrument Section	10832951	50.00	5.03		17.32	300.00
ACRt	Array Compensated True Resistivity Sonde Section	10809609	200.00	14.22		3.10	300.00
HFCS	Hostile Full Wave Sonic Caged Metal and Rubber Standoff	00000033	7.94	1.33	*	15.55	300.00
HFND	Mule Shoe	00000035	50.00	3.10		0.00	300.00
HFCS	Hostile Full Wave Sonic Caged Metal and Rubber Standoff	00000034	7.94	1.33	*	1.34	300.00
Total			**2,278.48**	**114.09**			

* Not included in Total Length and Length Accumulation.

Data: PIACENTINE 2-27\0001 TC_ICT_BSAT_CSNG_pge\IDLE **Date: 24-Mar-13 22:03:51**

COMPANY **PG&E**

WELL **PIACENTINE 2-27**

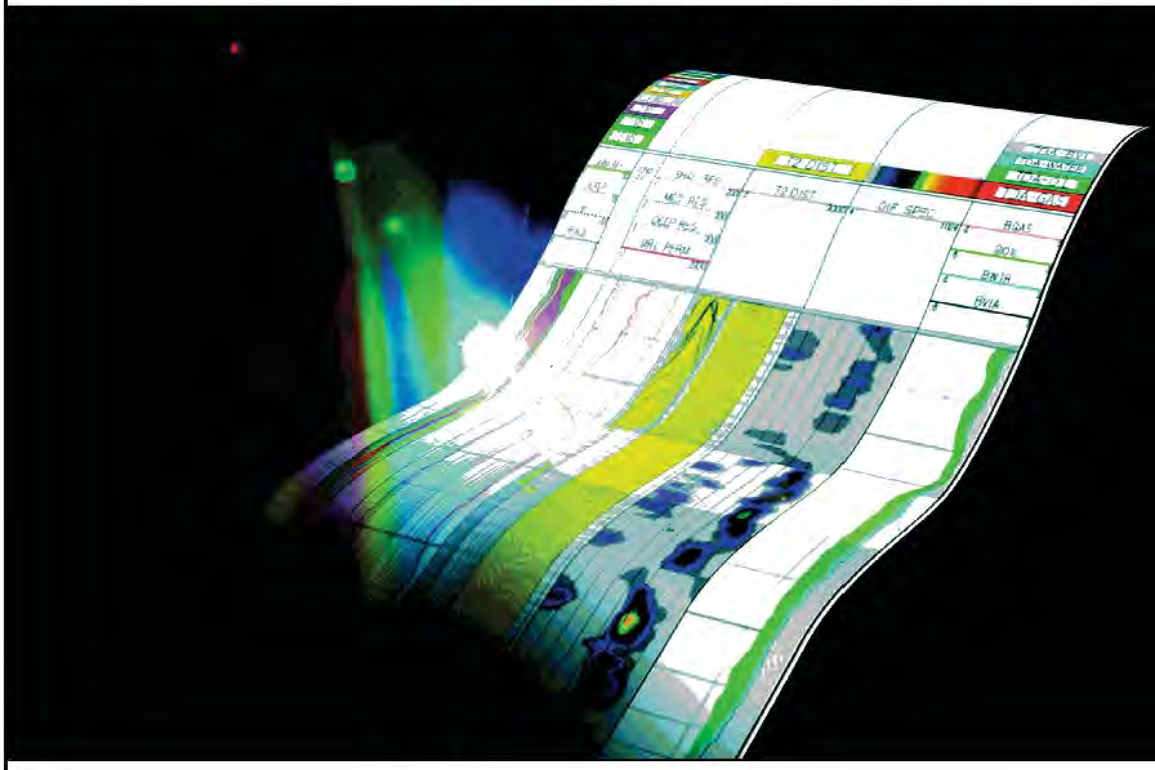
FIELD **KING ISLANDS GAS**

COUNTY **SAN JOAQUIN** STATE **CA**

HALLIBURTON

ARRAY COMPENSATED
TRUE RESISTIVITY
SPECTRAL DENSITY
DUAL SPACED NEUTRON
2"=100' & 5"=100'

HALLIBURTON



2DFC - T1T2 Analysis
Fluid Volumes

COMPANY	**PG&E**
WELL	**PIACENTINE 2-27**
FIELD/BLOCK	**KING ISLANDS GAS**
COUNTY	**SAN JOAQUIN** STATE **CA**

Location
LAT: 38.08155572
LONG:121.422162329

Elev.: K.B.	7.50	ft
D.F.	0.00	ft
G.L.	-4.50	ft

Date Processed	4/3/2013	Processed At	Bakersfield CA
Interval Processed	3890'-4866'	Processed By	Onur Ataman

Fold here

Service Ticket No.: 900310522 PGM Version: WL INSITE R3.8.4 (Build 5)

Date		25-Mar-13					
Run No.		1					
Depth - Driller		4970.00 ft					
Depth - Logger		4972.00 ft					
Bottom - Logged Interval							
Top - Logged Interval							
Casing - Driller		613.00 ft					
Casing - Logger		613.00 ft					
Bit Size		8.500					
Type Fluid in Hole		LSND					
Density	Viscosity	10.2 ppg	38.00 spqt				
PH	Fluid Loss	8.00 pH	4 mptm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		3.400 ohmm @ 72.00 degF		@		@	
Rmf @ Meas. Temperature		2.710 ohmm @ 69.00 degF		@		@	
Rmc @ Meas. Temperature		4.620 ohmm @ 69.00 degF		@		@	
Source Rmf	Rmc	FLOWLINE					
Rm @ BHT		2.06 ohmm @ 123.0 degF		@		@	
Time Since Circulation		15.9 hr					
Time on Bottom		25-Mar-13 08:56 ucts					
Max. Rec. Temperature		123.0 degF					
Equipment	Location	11871069	BKFLD		BKFLD		BKFLD
Recorded By		D. SANDOVAL					
Witnessed By		FRANK B. CRESSY					

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLE

Date	Sample No.				
Depth-Driller					
Type Fluid in Hole					
Density	Viscosity				
Ph	Fuild Loss				
Source of Sample					
Rm @ Meas. Temp		@		@	
Rmf @ Meas. Temp.		@		@	
Rmc @ Meas. Temp.		@		@	
Source Rmf	Rmc				
Rm @ BHT		@		@	
Rmf @ BHT		@		@	
Rmc @ BHT		@		@	

MRIL SCALE CHANGES

Type Log	Depth	Scale Up Hole	Scale Down Hole

MRIL EQUIPMENT DATA

Run No.	Tool Type & No.	Tool Pos.	Other	

LOGGING DATA

Number		Date/Time				MRIL Frequencies. (kHz)					Tool	Excluder
Run	Pass	Start	Stop	Activation	Amp	Freq 1	Freq 2	Freq 3	Freq 4	Freq 5	OD	OD

ACTIVATION PARAMETERS

Number		GROUP A				GROUP B				GROUP C				GROUP D				GROUP E			
Run	Pass	RA	TE	TW	NE	RA	TE	TW	NE	RA	TE	TW	NE	RA	TE	TW	NE	RA	TE	TW	NE

TOOLS - SERIAL NUMBERS

Run	Pass	D2TS/D4TG	MRCC	MRCC	MREC	MRSN	MRSS	GR	DTD	ASWH	ACRx	

MRIL MISCELLANEOUS INFO

Hoist:	Time in Hole:	
No. Overbody Centralizers:	No. of Stand Offs:	Stand Off OD:
Tool String Combination (Top to Bottom):		

DIRECTIONAL INFORMATION

Maximum Deviation	@	KOP	@

Remarks:

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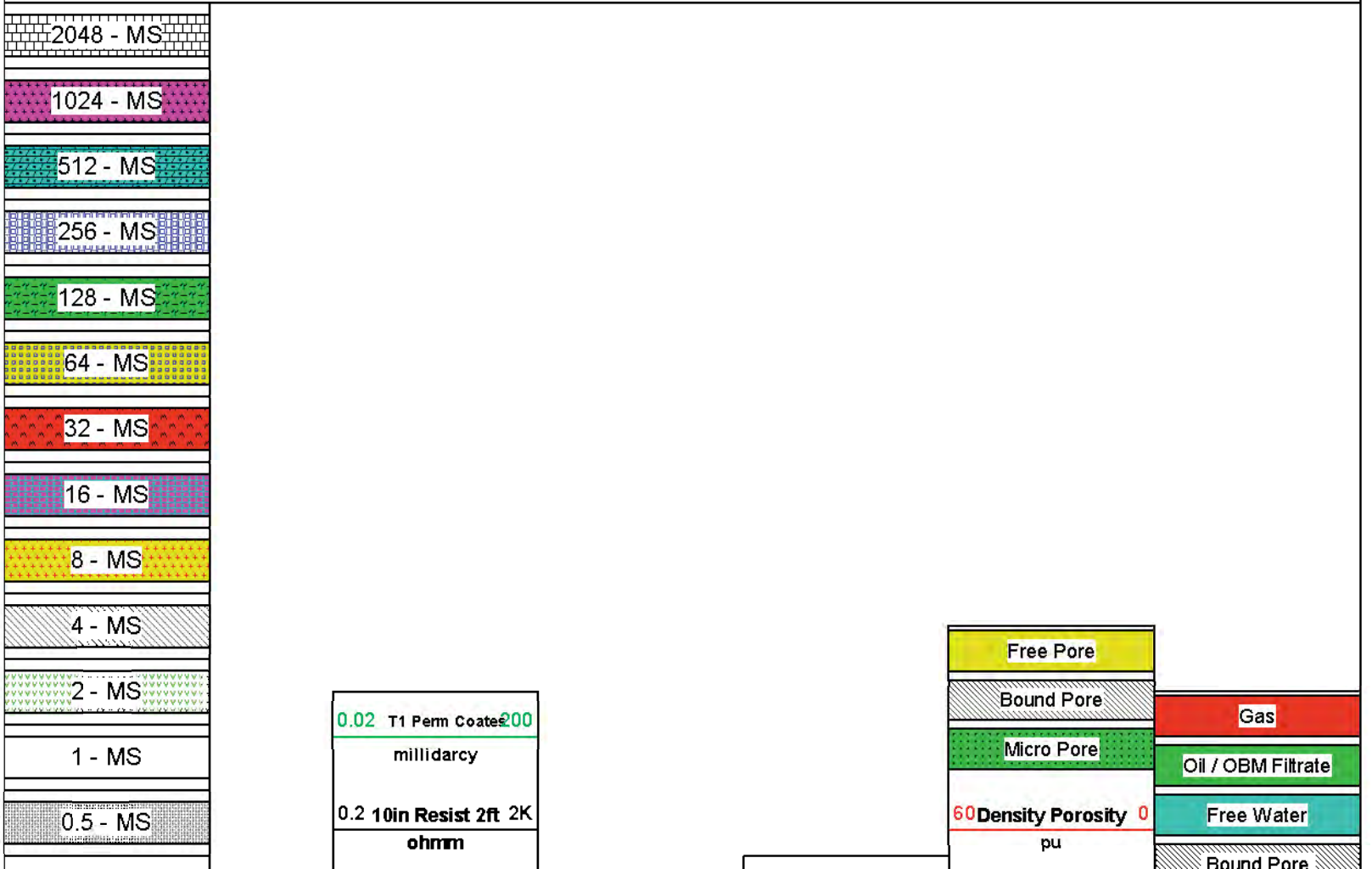
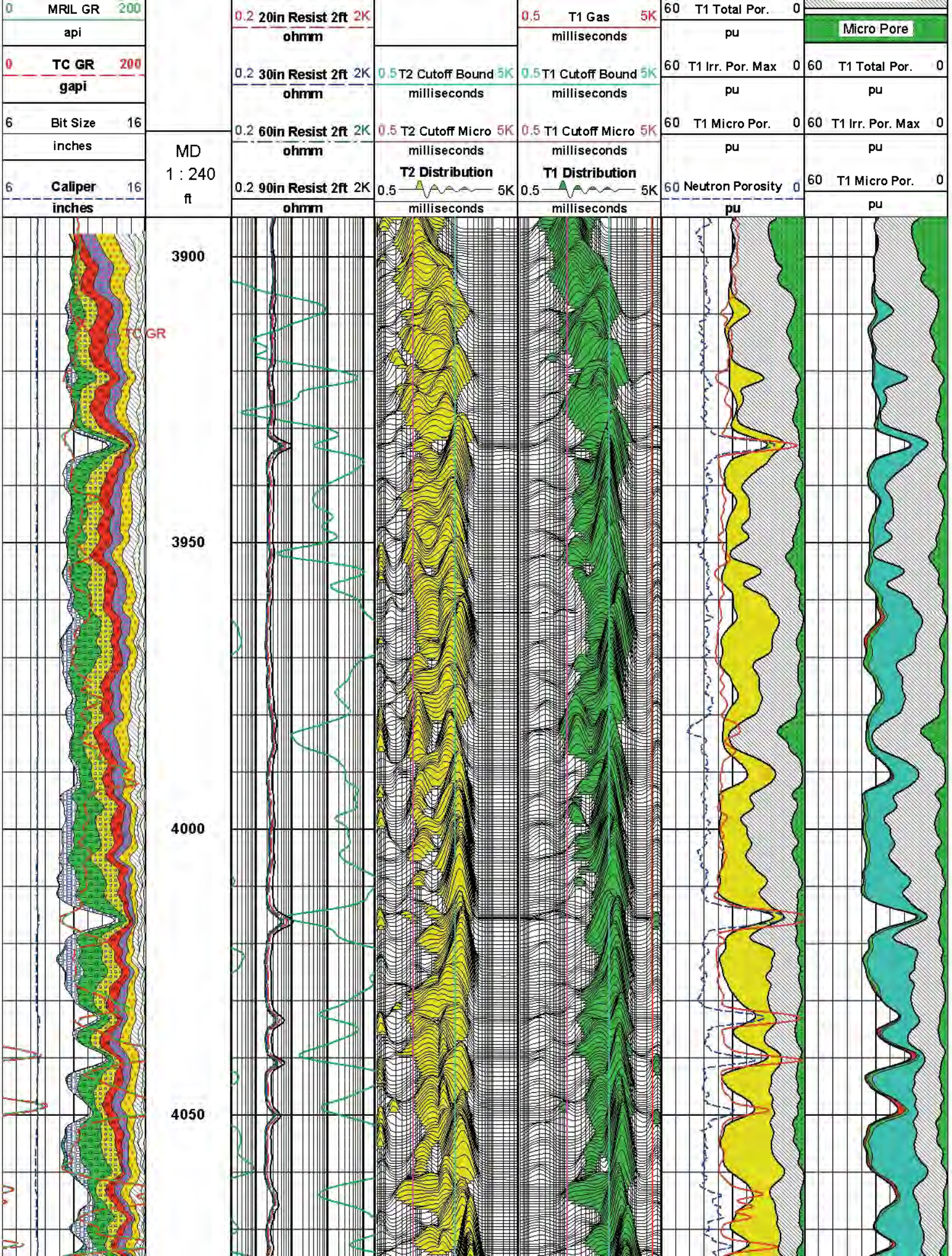
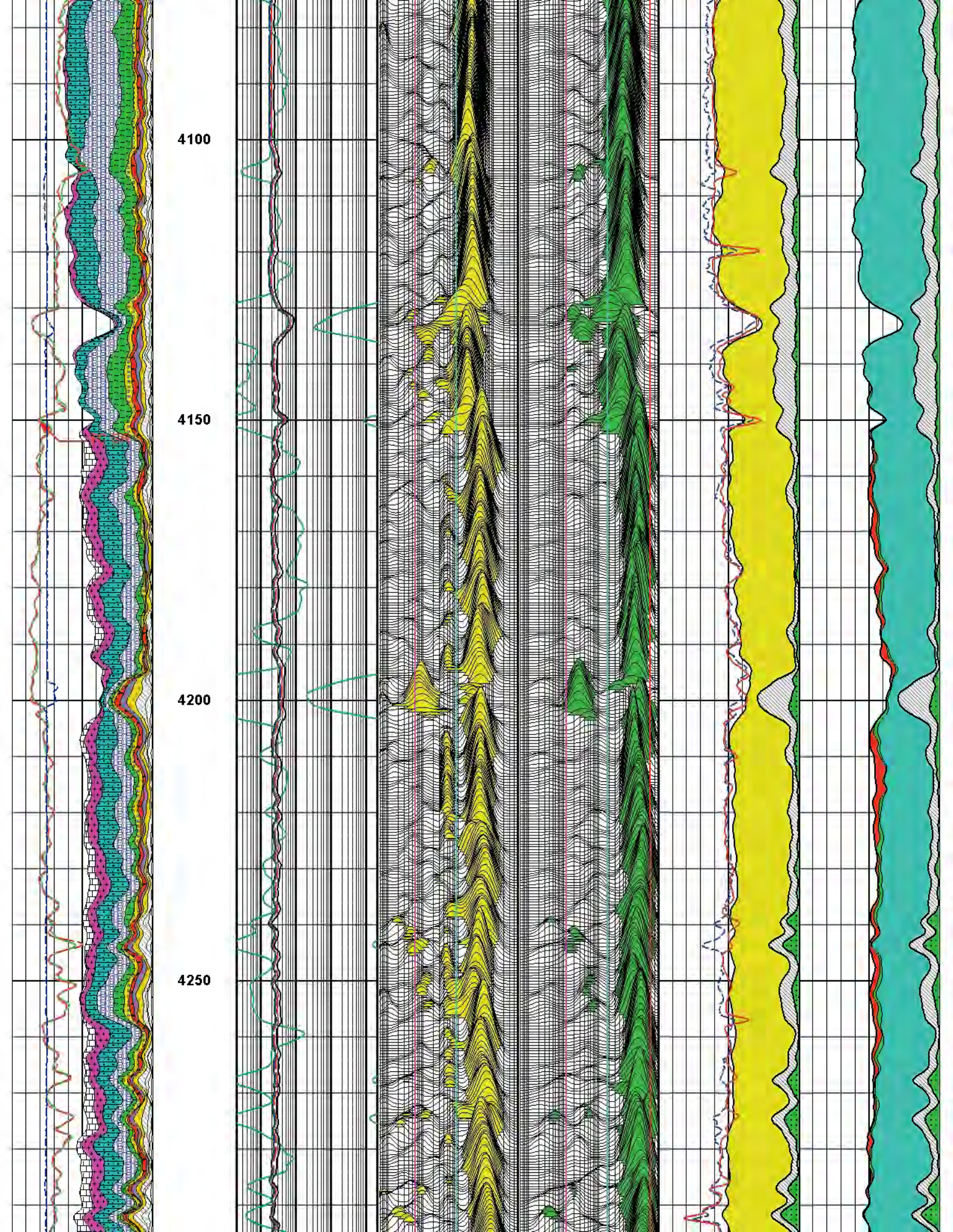
HALLIBURTON

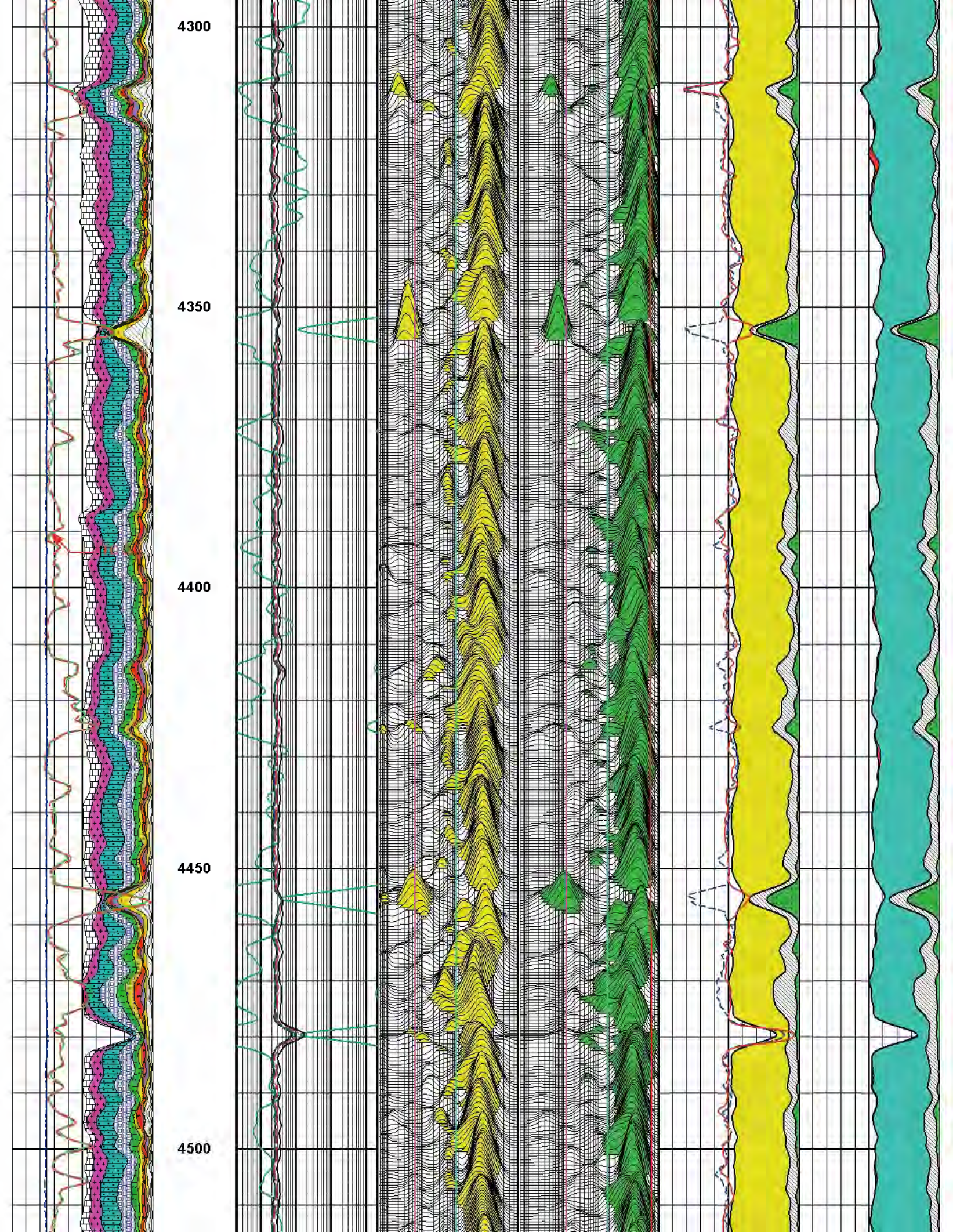
HALLIBURTON

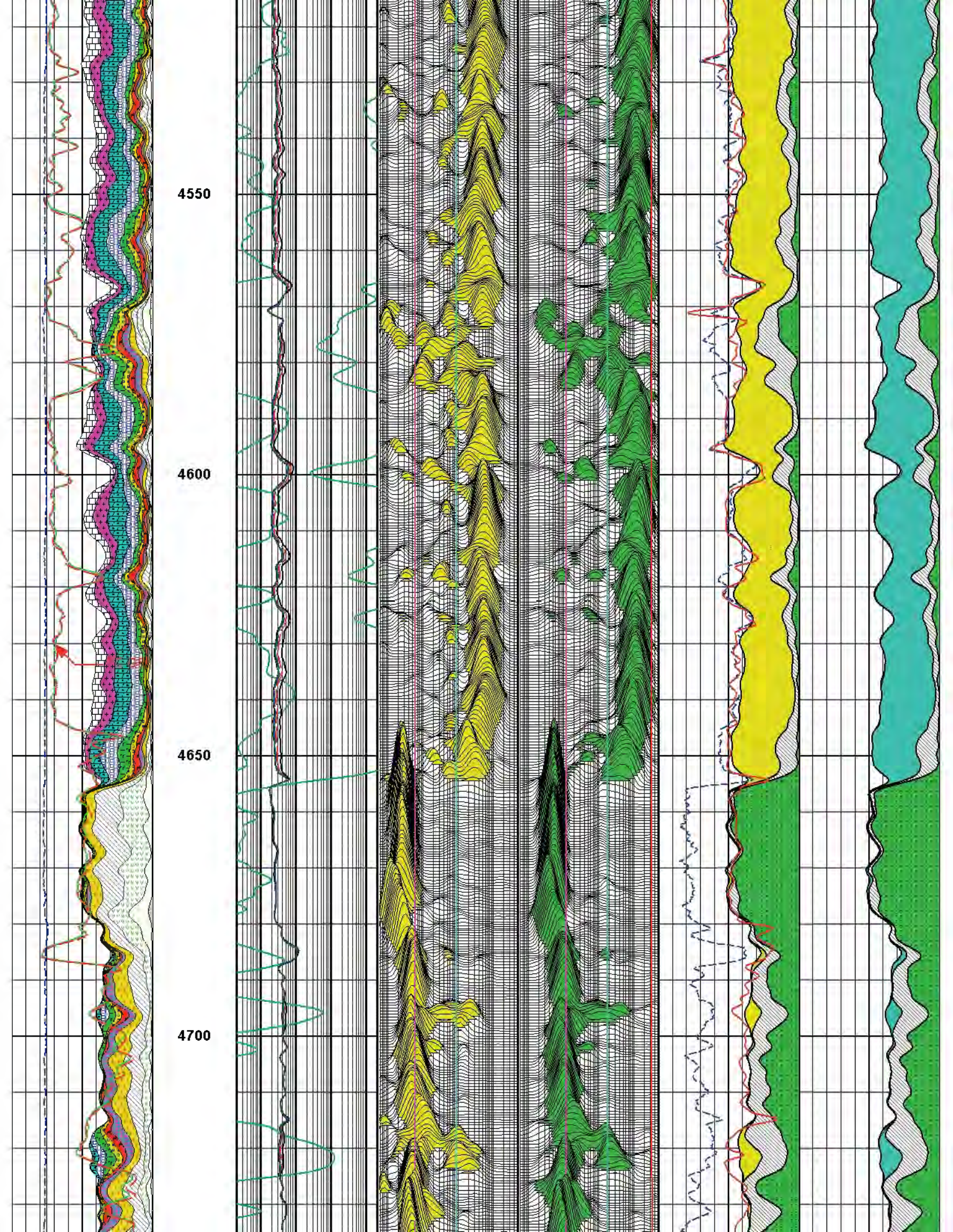
Plot Time: 03-Apr-13 14:28:34
Plot Range: 3893 ft to 4867 ft
Data: PIACENTINE 2-27***
Plot File: \\-LOCAL-\PIACENTINE 2-27\0004 MRIL_pge\T1T2\FRS_MRIL_T1T2_Vol_OBM

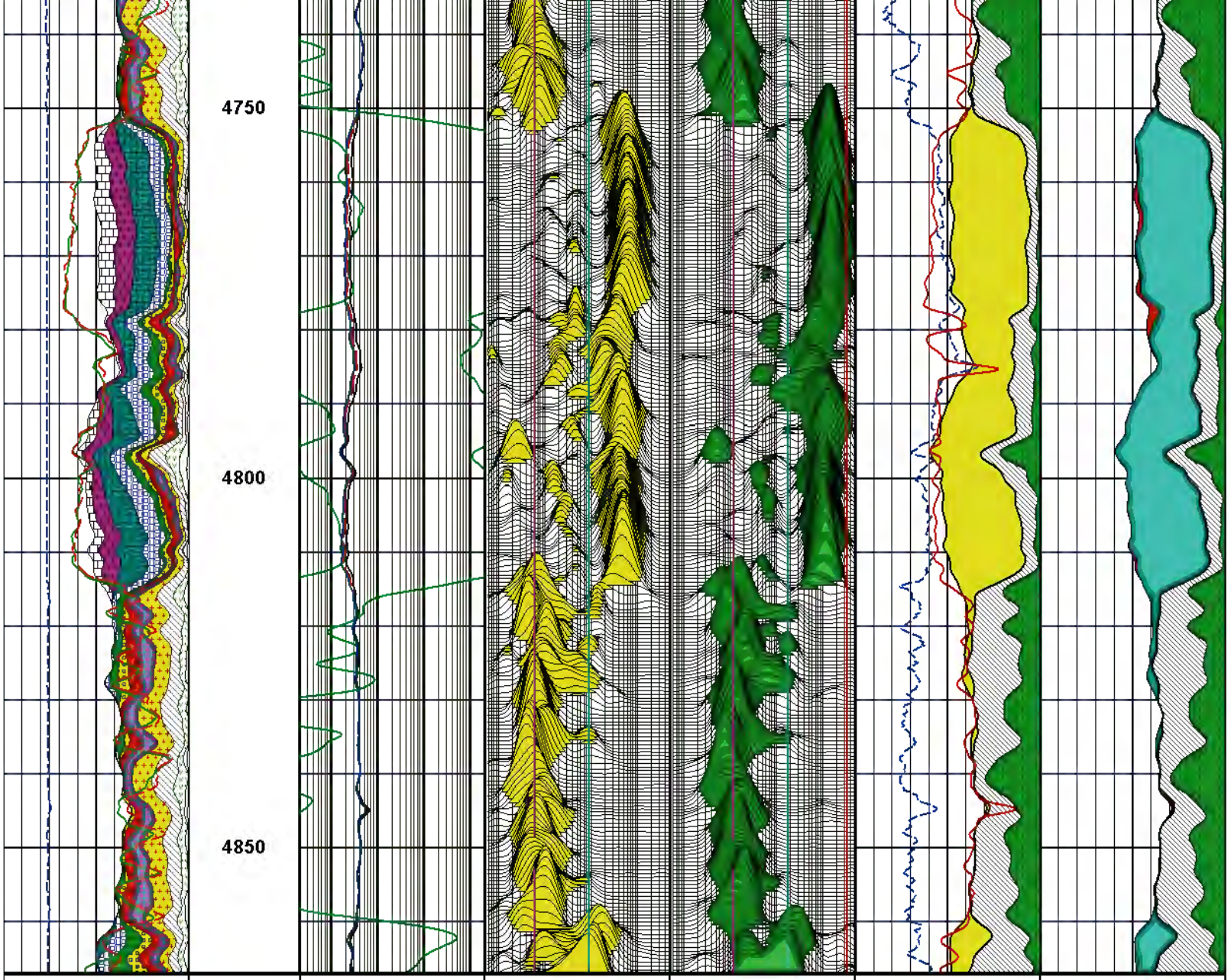



0 MRIL GR 200
api
0 TC GR 200
gapi
6 Bit Size 16
inches
6 Caliper 16
inches
MD
1 : 240
ft
0.2 20in Resist 2ft 2K
ohmm
0.2 30in Resist 2ft 2K
ohmm
0.2 60in Resist 2ft 2K
ohmm
0.2 90in Resist 2ft 2K
ohmm
0.5 T2 Cutoff Bound 5K
milliseconds
0.5 T2 Cutoff Micro 5K
milliseconds
T2 Distribution
0.5 5K
milliseconds
0.5 T1 Gas 5K
milliseconds
0.5 T1 Cutoff Bound 5K
milliseconds
0.5 T1 Cutoff Micro 5K
milliseconds
T1 Distribution
0.5 5K
milliseconds
60 T1 Total Por. 0
pu
60 T1 Irr. Por. Max 0
pu
60 T1 Micro Por. 0
pu
60 Neutron Porosity 0
pu
Micro Pore
60 T1 Total Por. 0
pu
60 T1 Irr. Por. Max 0
pu
60 T1 Micro Por. 0
pu
3900
3950
4000
4050
TC GR

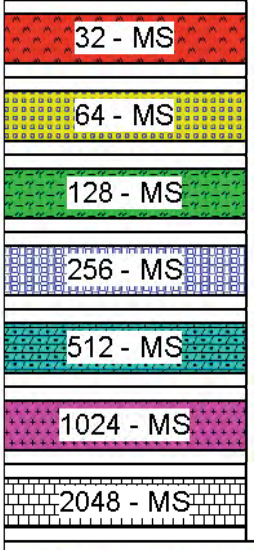

4100
4150
4200
4250


4300
4350
4400
4450
4500


4550
4600
4650
4700



6 Caliper 16	MD	0.2 90in Resist 2ft 2K	T2 Distribution	T1 Distribution	60 Neutron Porosity 0	60 T1 Micro Por. 0
inches	1 : 240	ohmm	0.5 5K	0.5 5K	pu	pu
6 Bit Size 16	ft	0.2 60in Resist 2ft 2K	milliseconds	milliseconds	60 T1 Micro Por. 0	60 T1 Irr. Por. Max 0
inches		ohmm	0.5 T2 Cutoff Micro 5K	0.5 T1 Cutoff Micro 5K	pu	pu
0 TC GR 200		0.2 30in Resist 2ft 2K	milliseconds	milliseconds	60 T1 Irr. Por. Max 0	60 T1 Total Por. 0
gapi		ohmm	0.5 T2 Cutoff Bound 5K	0.5 T1 Cutoff Bound 5K	pu	pu
0 MRIL GR 200		0.2 20in Resist 2ft 2K	milliseconds	milliseconds	60 T1 Total Por. 0	Micro Pore
api		ohmm		0.5 T1 Gas 5K	pu	Bound Pore
0.5 - MS		0.2 10in Resist 2ft 2K		milliseconds	60 Density Porosity 0	Free Water
1 - MS		ohmm			pu	Oil / OBM Filtrate
2 - MS		0.02 T1 Perm Coates 200			Micro Pore	Gas
4 - MS		millidarcy			Bound Pore	
8 - MS					Free Pore	
16 - MS						



HALLIBURTON

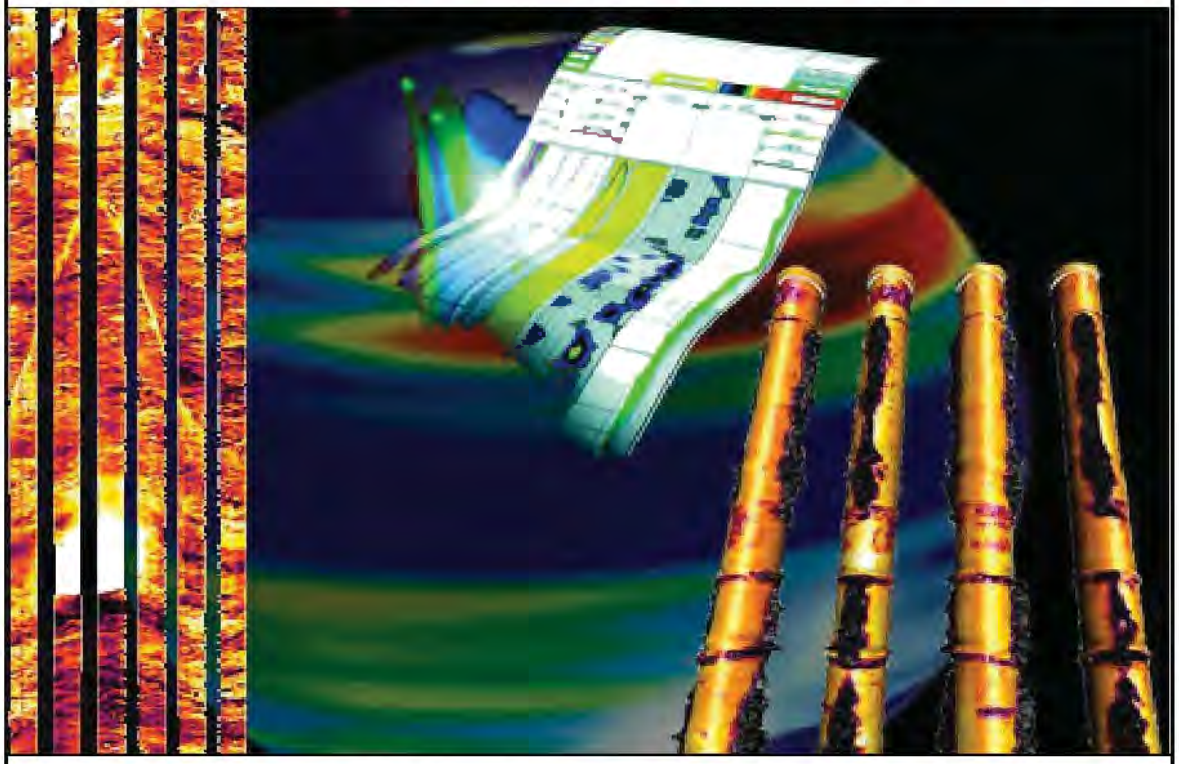
Plot Time: 03-Apr-13 14:28:43
Plot Range: 3893 ft to 4867 ft
Data: PIACENTINE 2-27***
Plot File: \\-LOCAL-\PIACENTINE 2-27\0004 MRIL_pge\T1T2\FRS_MRIL_T1T2_Vol_OBM

COMPANY	**PG&E**		
WELL	**PIACENTINE 2-27**		
FIELD	**KING ISLANDS GAS**		
COUNTY	**SAN JOAQUIN**	STATE	**CA**

HALLIBURTON

2DFC - T1T2 Analysis
Fluid Volumes

HALLIBURTON



X-tended Range Micro Imager
Correlation Plot
1:240

COMPANY	**PG&E**		
WELL	**PIACENTINE 2-27**		
FIELD	**KING ISLANDS GAS**		
COUNTY	**SAN JOAQUIN**	STATE	**CA**

Location
LAT: 38.08155572
LONG:121.422162329

Elev.: K.B.	7.50 ft
D.F.	0.00 ft
G.L.	-4.50 ft

Date Processed	4/1/2013	Processed At	Bakersfield CA
Interval Processed	4630'-4830'	Processed By	Onur Ataman

Fold here

Service Ticket No.: 900310522 PGM Version: WL INSITE R3.8.4 (Build 5)

Logs Processed: Date Logged: Type Fluid In Hole:

DIRECTIONAL INFORMATION

Maximum Deviation	@	KOP	@

Remarks

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HALLIBURTON



Bedding Dip Azimuth



degrees

Sedimentary Bed

0 90

degrees

Structural Dip

0 90

degrees

Deformed Bed

0 90

degrees

Erosional Surface

0 90

degrees

Compaction Bed

0 90

degrees

Fracture Azimuth



degrees

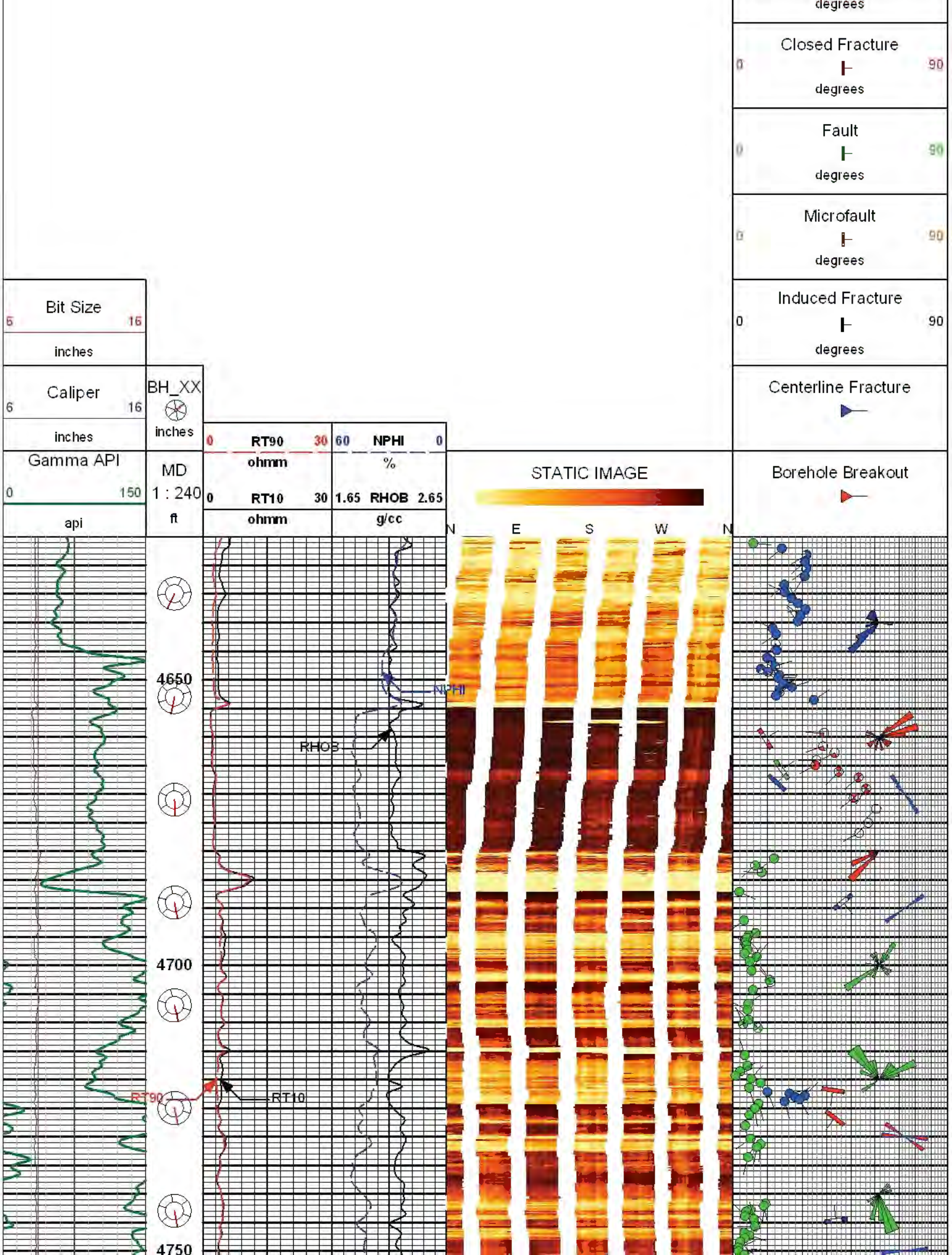
Open Fracture

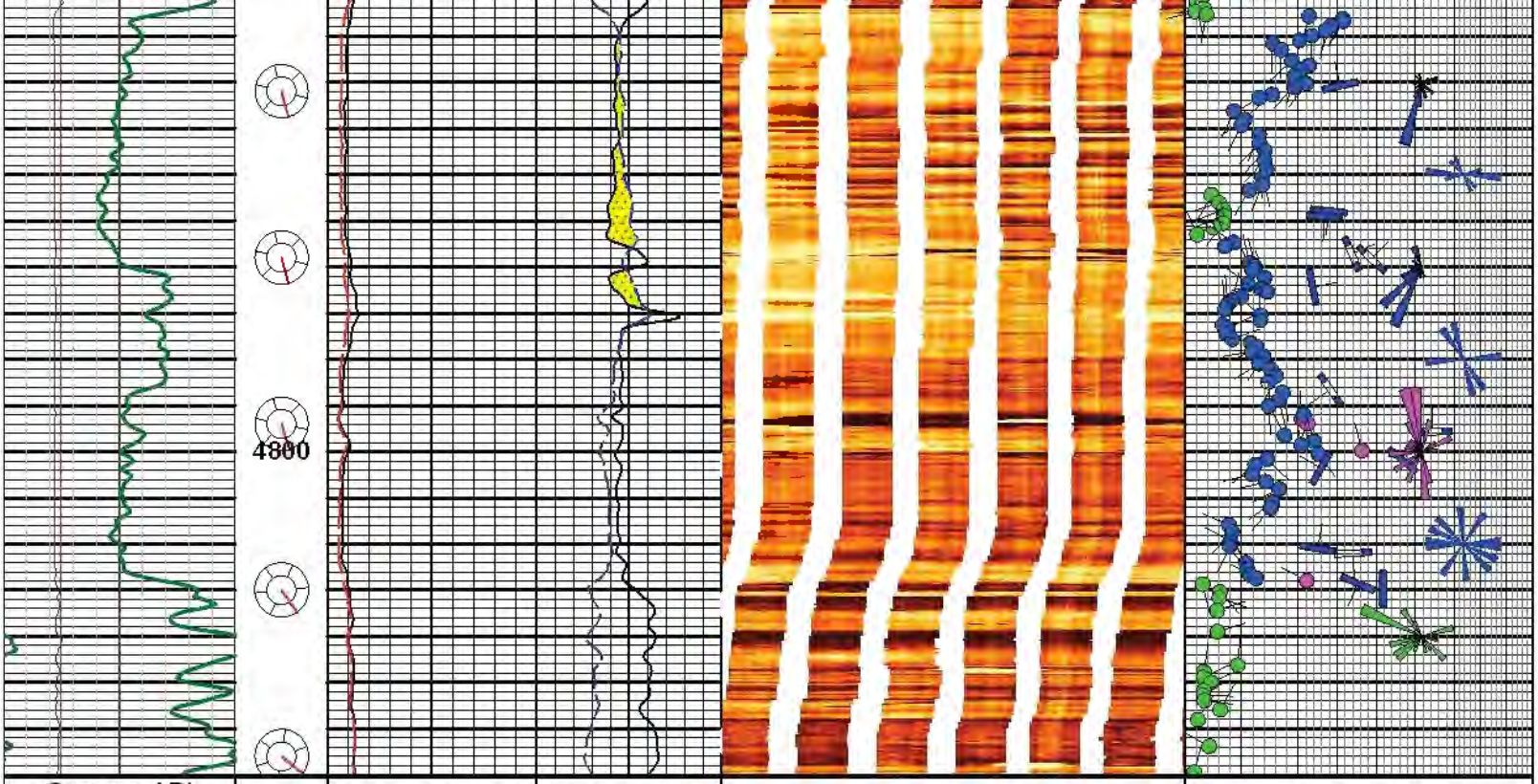
0 90

degrees

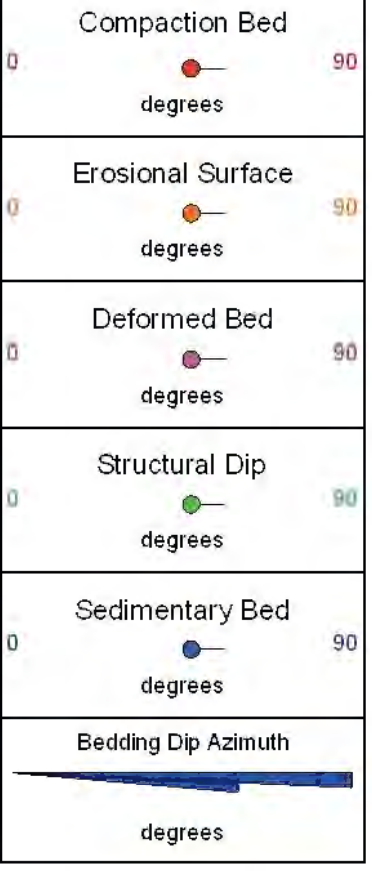
Partial Fracture

0 90


Bit Size
5
16
inches
Caliper
6
16
inches
Gamma API
0
150
api
BH_XX
inches
MD
1 : 240
ft
0
RT90
30
ohmm
0
RT10
30
ohmm
60
NPHI
0
%
1.65
RHOB
2.65
g/cc
STATIC IMAGE
N
E
S
W
N
Closed Fracture
0
90
degrees
Fault
0
90
degrees
Microfault
0
90
degrees
Induced Fracture
0
90
degrees
Centerline Fracture
Borehole Breakout
4650
4700
4750
NPHI
RHOB
RT90
RT10



Gamma API	MD	RT10 / RT90	RHOB / NPHI	STATIC IMAGE	Borehole Breakout
0 — 150	1 : 240	0 — 30 ohmm	1.65 — 2.65 g/cc	N E S W N	
api	ft	0 — 30 ohmm	60 — 0 %		Centerline Fracture
Caliper	BH_XX				
6 — 16					Induced Fracture
inches	inches				0 — 90 degrees
Bit Size					Microfault
6 — 16					0 — 90 degrees
inches					Fault
					0 — 90 degrees
					Closed Fracture
					0 — 90 degrees
					Partial Fracture
					0 — 90 degrees
					Open Fracture
					0 — 90 degrees
					Fracture Azimuth
					degrees



COMPANY	**PG&E**		
WELL	**PIACENTINE 2-27**		
FIELD	**KING ISLANDS GAS**		
COUNTY	**SAN JOAQUIN**	STATE	**CA**

HALLIBURTON

X-tended Range Micro Imager
Correlation Plot
1:240

HALLIBURTON



X-tended Range Micro Imager
Borehole Breakout Plot
1:240

COMPANY	**PG&E**		
WELL	**PIACENTINE 2-27**		
FIELD	**KING ISLANDS GAS**		
COUNTY	**SAN JOAQUIN**	STATE	**CA**

Location
LAT: 38.08155572
LONG:121.422162329

Elev.: K.B.	7.50 ft
D.F.	0.00 ft
G.L.	-4.50 ft

Date Processed 4/1/2013 Processed At Bakersfield CA
Interval Processed 4630'-4830' Processed By Onur Ataman

Fold here

Service Ticket No.: 900310522 PGM Version: WL INSITE R3.8.4 (Build 5)
Logs Processed: Date Logged: Type Fluid In Hole:

DIRECTIONAL INFORMATION

Maximum Deviation @ KOP @

Remarks:

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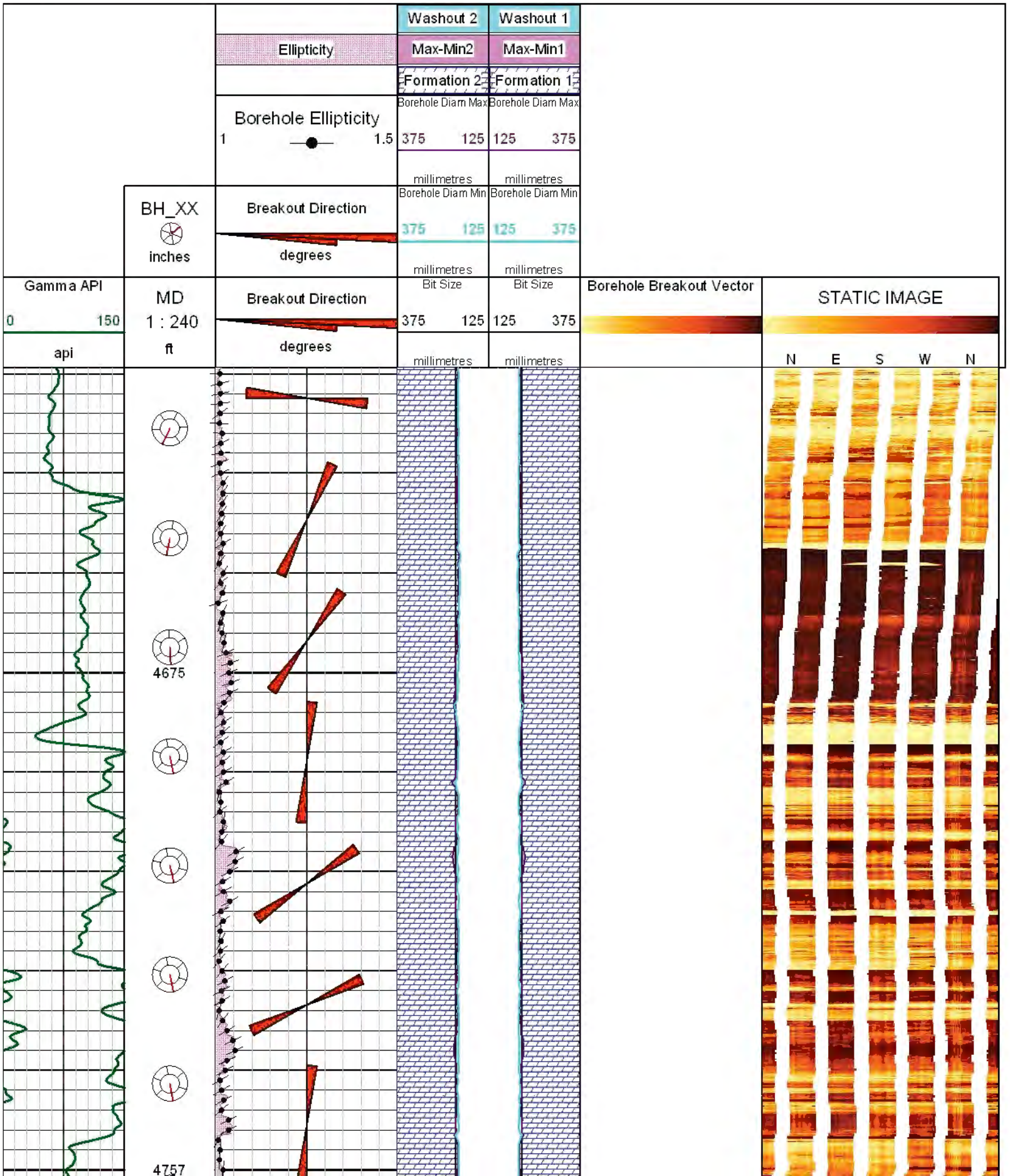
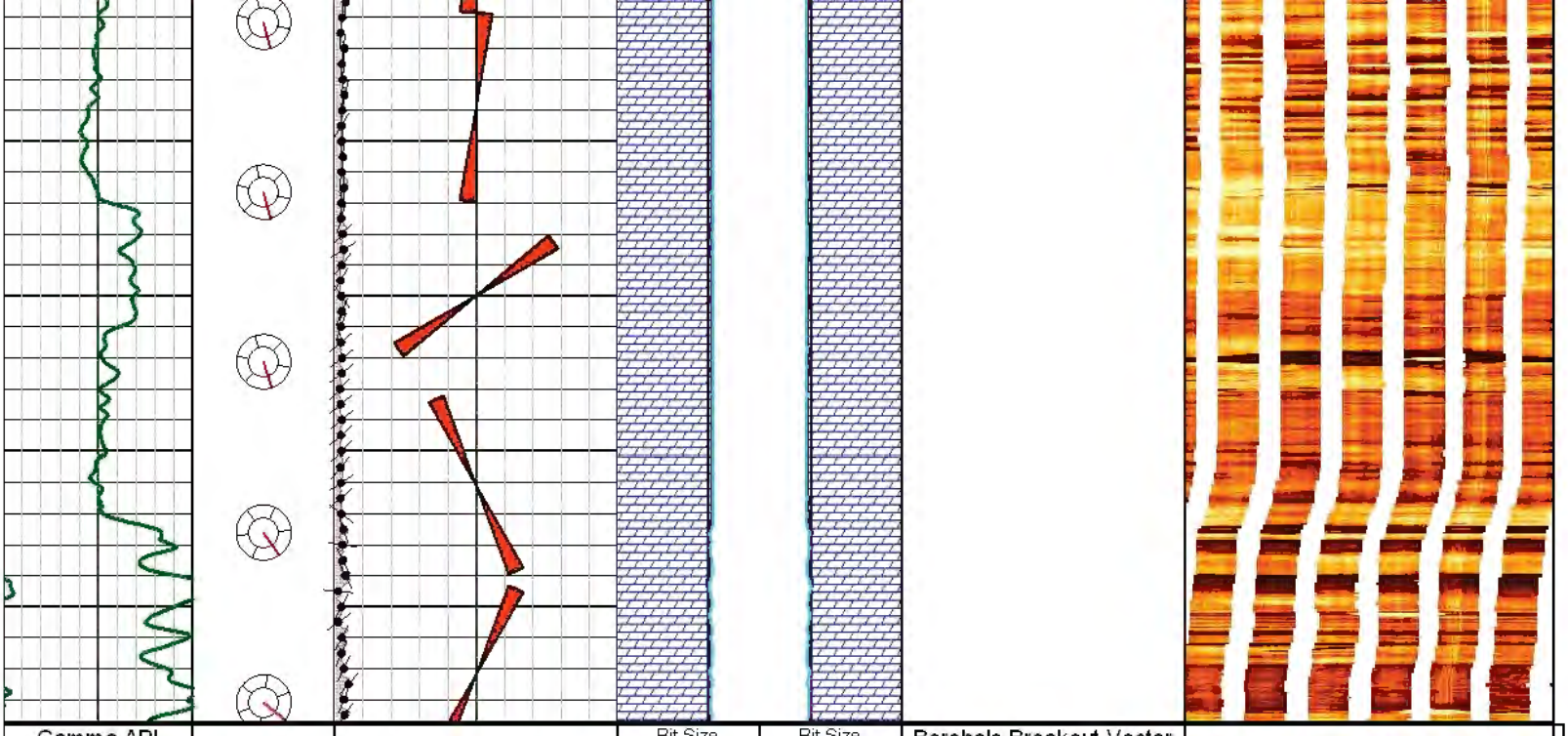
HALLIBURTON





COMPANY	**PG&E**
WELL	**PIACENTINE 2-27**
FIELD	**KING ISLANDS GAS**
COUNTY	**SAN JOAQUIN**
STATE	**CA**

HALLIBURTON

X-tended Range Micro Imager
Borehole Breakout Plot
1:240

HALLIBURTON



X-tended Range Micro Imager
Fracture Frequency Plot
1:240

COMPANY	**PG&E**
WELL	**PIACENTINE 2-27**
FIELD	**KING ISLANDS GAS**
COUNTY	**SAN JOAQUIN** STATE **CA**

Location
LAT: 38.08155572
LONG:121.422162329

Elev.: K.B.	7.50 ft
D.F.	0.00 ft
G.L.	-4.50 ft

Date Processed 4/1/2013 Processed At Bakersfield CA
Interval Processed 4630'-4830' Processed By Onur Ataman

Fold here

Service Ticket No.: 900310522 PGM Version: WL INSITE R3.8.4 (Build 5)
Logs Processed: Date Logged: Type Fluid In Hole:

DIRECTIONAL INFORMATION

Maximum Deviation @ KOP @

Remarks:

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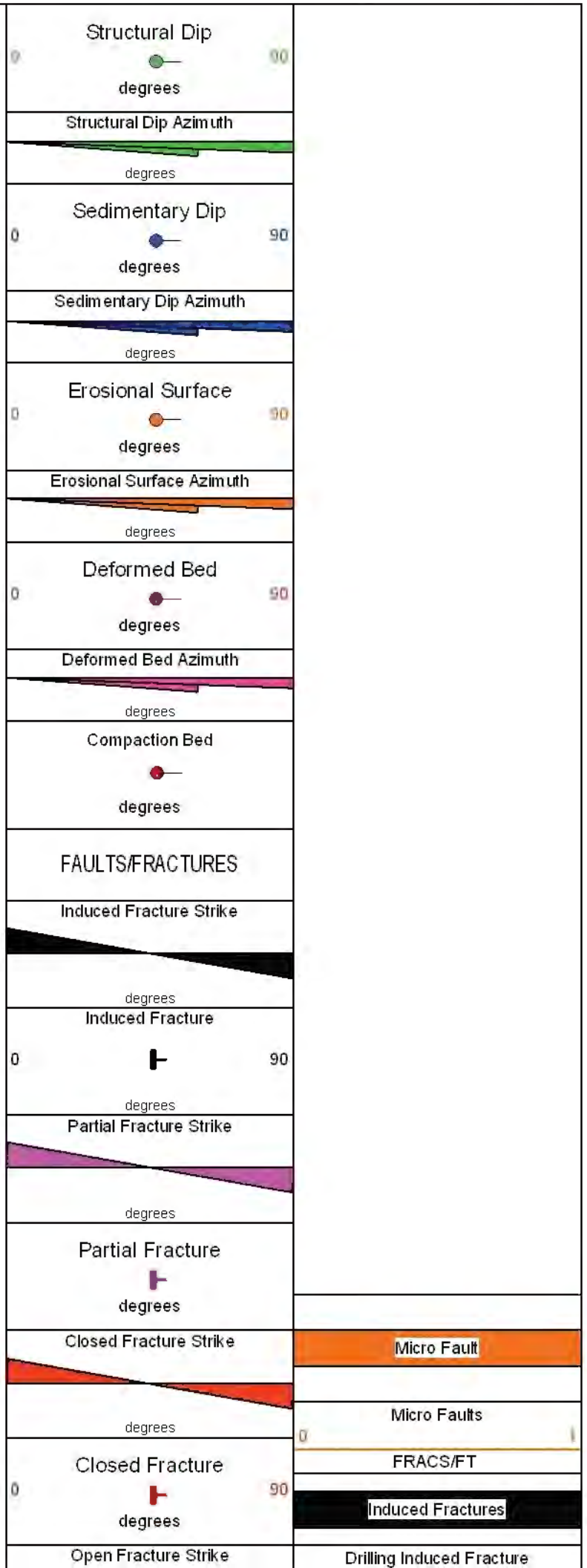
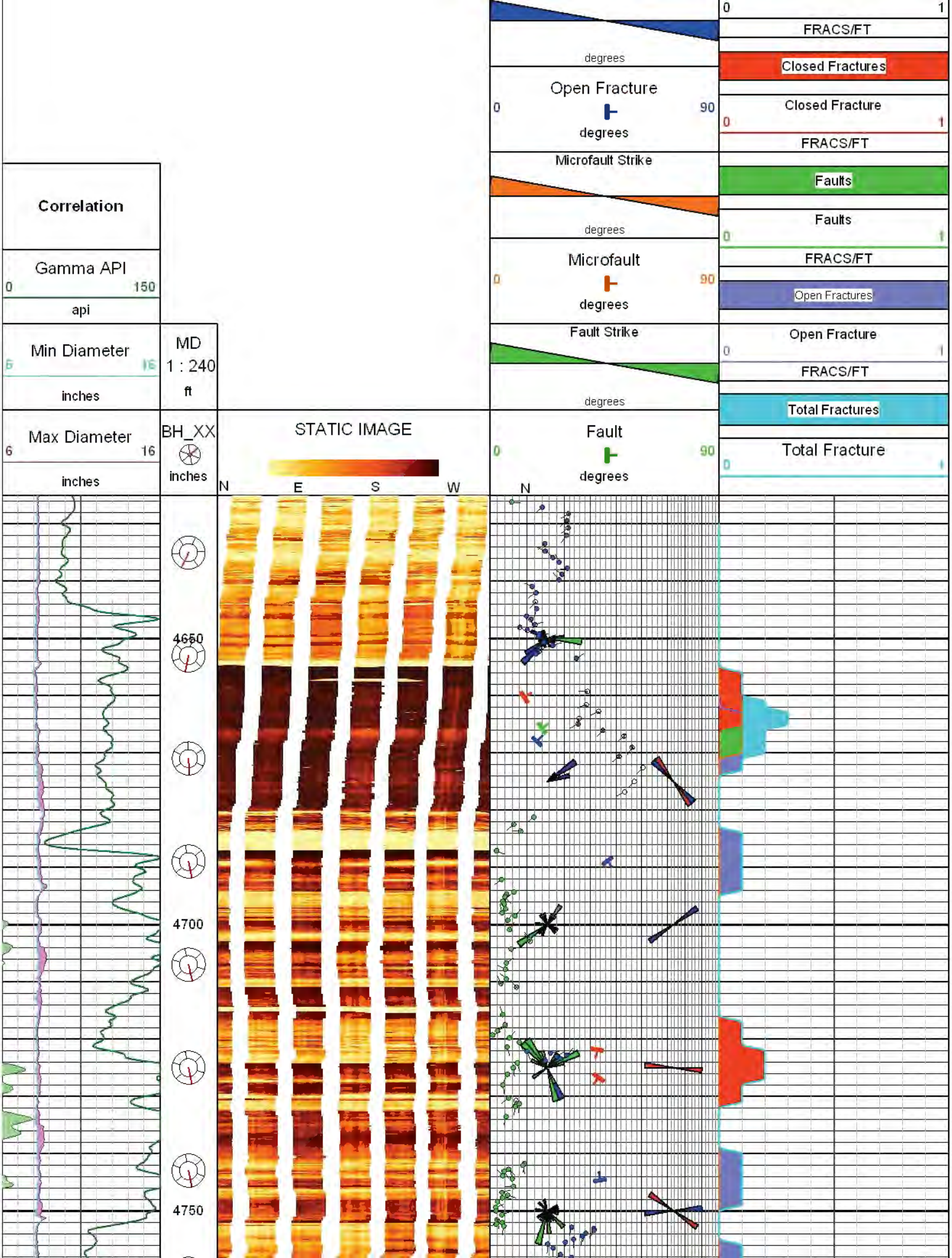
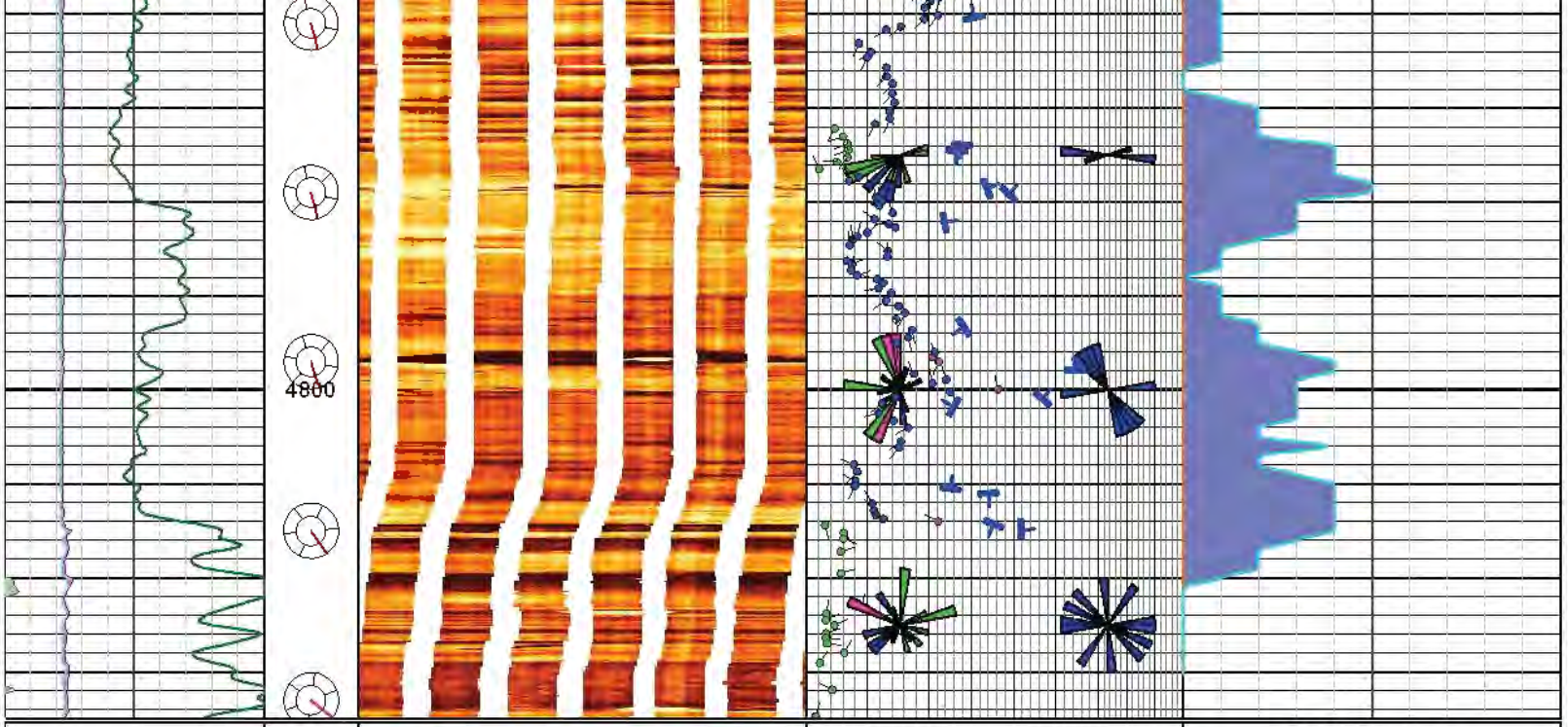
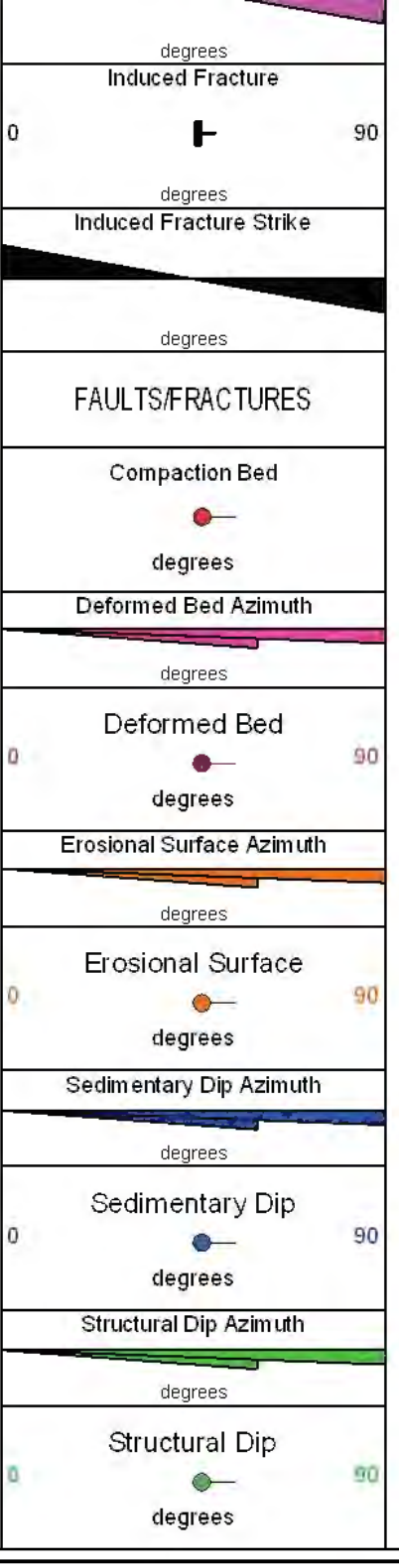
HALLIBURTON


Structural Dip
0
90
degrees
Structural Dip Azimuth
degrees
Sedimentary Dip
0
90
degrees
Sedimentary Dip Azimuth
degrees
Erosional Surface
0
90
degrees
Erosional Surface Azimuth
degrees
Deformed Bed
0
90
degrees
Deformed Bed Azimuth
degrees
Compaction Bed
degrees
FAULTS/FRACTURES
Induced Fracture Strike
degrees
Induced Fracture
0
90
degrees
Partial Fracture Strike
degrees
Partial Fracture
degrees
Closed Fracture Strike
degrees
Closed Fracture
0
90
degrees
Open Fracture Strike
Micro Fault
Micro Faults
0
1
FRACS/FT
Induced Fractures
Drilling Induced Fracture


Correlation
Gamma API
0
150
api
Min Diameter
6
16
inches
Max Diameter
6
16
inches
MD
1 : 240
ft
BH_XX
inches
STATIC IMAGE
N
E
S
W
4650
4700
4750
degrees
Open Fracture
0
90
degrees
Microfault Strike
degrees
Microfault
0
90
degrees
Fault Strike
degrees
Fault
0
90
degrees
N
0
1
FRACS/FT
Closed Fractures
Closed Fracture
0
1
FRACS/FT
Faults
Faults
0
1
FRACS/FT
Open Fractures
Open Fracture
0
1
FRACS/FT
Total Fractures
Total Fracture
0
1



Max Diameter 6 16 inches	BH_XX inches	STATIC IMAGE N E S W	Fault 0 90 degrees N Fault Strike degrees	Total Fracture 0 1 Total Fractures Open Fracture 0 1 FRACS/FT Open Fractures Faults 0 1 FRACS/FT Faults Closed Fracture 0 1 FRACS/FT Closed Fractures Drilling Induced Fracture 0 1 FRACS/FT Induced Fractures Micro Faults 0 1 FRACS/FT Micro Fault
Min Diameter 6 16 inches	MD 1 : 240 ft		Microfault 0 90 degrees Microfault Strike degrees	
Gamma API 0 150 api			Open Fracture 0 90 degrees Open Fracture Strike degrees	
Correlation			Closed Fracture 0 90 degrees Closed Fracture Strike degrees	
			Partial Fracture degrees Partial Fracture Strike	



COMPANY	**PG&E**		
WELL	**PIACENTINE 2-27**		
FIELD	**KING ISLANDS GAS**		
COUNTY	**SAN JOAQUIN**	STATE	**CA**

HALLIBURTON

X-tended Range Micro Imager
Fracture Frequency Plot
1:240

HALLIBURTON

SIDE WALL CORE

5"=100'

COMPANY	PG&E
WELL	PIACENTINE 2-27
FIELD/BLOCK	KING ISLANDS GAS
COUNTY	SAN JOAQUIN
STATE	CA

API No. 04-077-20736

Location LAT: 38.08155572
LONG:121.422162329

Sect. 27 Twp. 3N Rge. 5E

Other Services:
ACRT / SDL / DSN
BSAT
CSNG
ICT
ML
XRMI
MRIL / RDT

Permanent Datum	GL	Elev. -4.5 ft	Elev.: K.B. 7.5 ft
Log measured from	KB	, 12.0 ft above perm. Datum	D.F. 0.0 ft
Drilling measured from	KB		G.L. -4.5 ft

Date		26-Mar-13					
Run No.		1					
Depth - Driller		4970.00 ft					
Depth - Logger		4972.0 ft					
Bottom - Logged Interval		4809.0 ft					
Top - Logged Interval		4640.0 ft					
Casing - Driller		9.625 in @ 613.0 ft		@		@	
Casing - Logger		613.0 ft					
Bit Size		8.500 in		@		@	
Type Fluid in Hole		LSND					
Density	Viscosity	10.2 ppg	38.00 s/qt				
PH	Fluid Loss	8.00 pH	3.9 cptm				
Source of Sample		FLOWLINE					
Rm @ Meas. Temperature		3.400 ohmm @ 72.00 degF		@		@	
Rmf @ Meas. Temperature		2.71 ohmm @ 69.00 degF		@		@	
Rmc @ Meas. Temperature		4.620 ohmm @ 69.00 degF		@		@	
Source Rmf	Rmc	MEAS	MEAS				
Rm @ BHT		2.06 ohmm @ 123.0 degF		@		@	
Time Since Circulation		44.2 hr					
Time on Bottom		26-Mar-13 10:47					
Max. Rec. Temperature		123.0 degF @		@		@	
Equipment	Location	11871069	BKSFLD				
Recorded By		D. SANDOVAL					
Witnessed By		FRANK B. CRESSY					

Fold here

Service Ticket No.: 900310522 API Serial No.: 04-077-20736 PGM Version: WL INSITE R3.8.4 (Build 5)

DIRECTIONAL INFORMATION

Maximum Deviation @ KOP @

Remarks:

24 SWC RECOVERED.

CREW: F. VARGAS, B. CONTRERAS, A. VAZQUEZ RIG: PG 4

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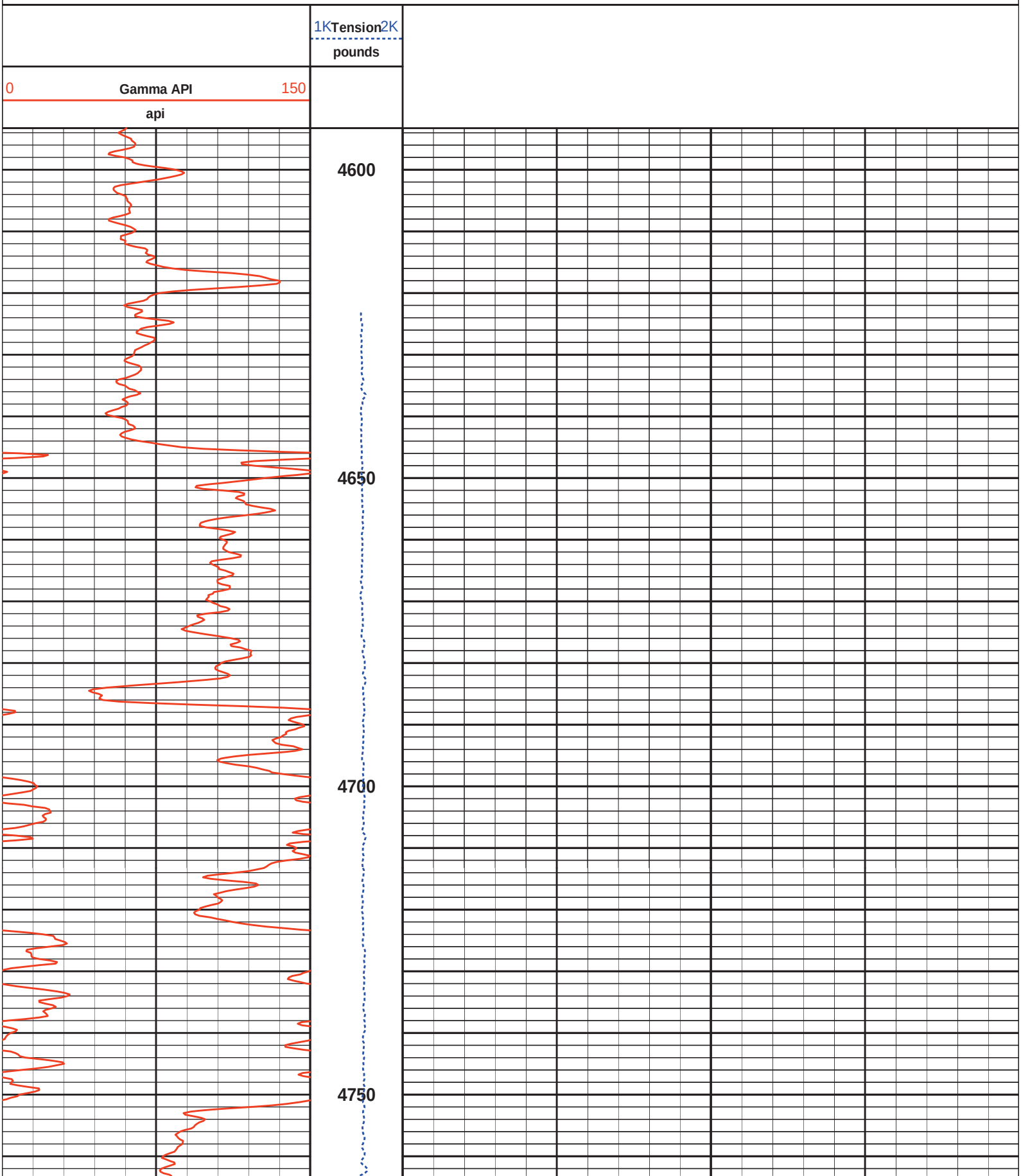
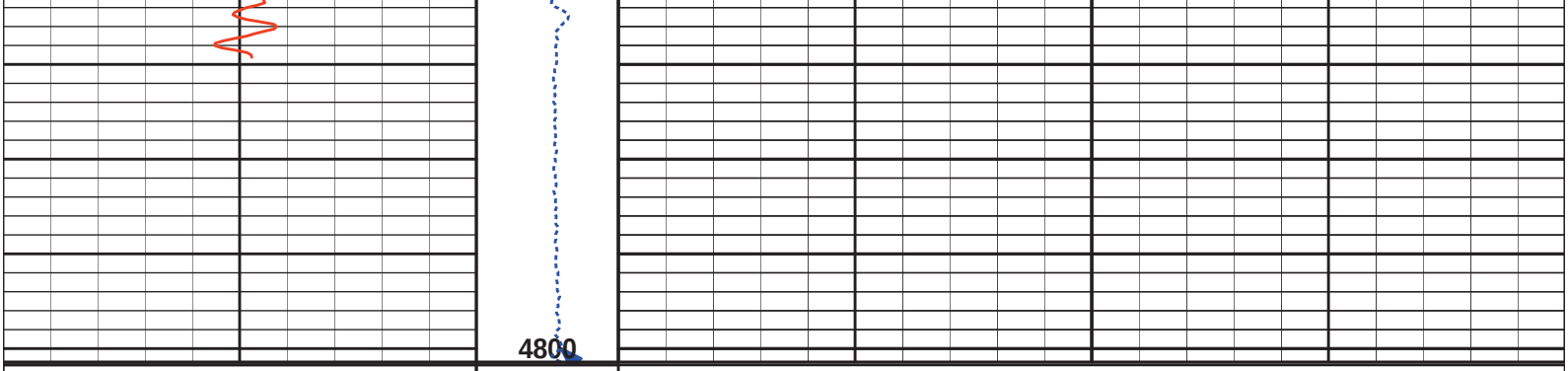
HALLIBURTON

HALLIBURTON

Plot Time: 26-Mar-13 15:32:27
Plot Range: 4593.25 ft to 4801.42 ft
Data: PIACENTINE 2-27\Well Based\DAQ-0005-003\
Plot File: \\-LOCAL-\PIACENTINE 2-27\0005 SWC PGE\SWC PLOT\Gamma Tie-In

TIE IN PASS 5"=100'





HALLIBURTON

Plot Time: 26-Mar-13 15:32:28
Plot Range: 4593.25 ft to 4801.42 ft
Data: PIACENTINE 2-27\Well Based\DAQ-0005-003\
Plot File: \\-LOCAL-\PIACENTINE 2-27\0005 SWC_PGE\SWC_PLOT\Gamma Tie-In

HALLIBURTON

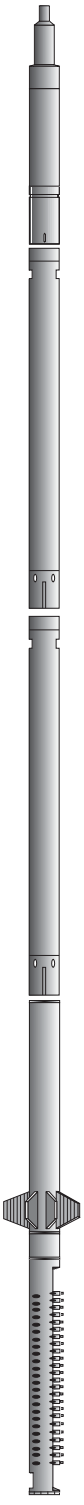
CORE GUN REPORT

Company: PG&E
Well: PIACENTINE 2-27
Tool Name: Digital Core Gun - Gearhart Gun
Serial Number: 00000013
Cores Requested: 24
Barrel Type: REGULAR
Cores Attempted: 24
Charge Type:
Cores Recovered: 24
Release Ring: ----------
Misfires: 0
Core Diameter: 1.00
Shoot Offs: 0
Pull Offs: 0

Core #	Depth	Shot Fire/Flagged	Gun ID	Shot #	Status	Drift	Tool Face	Core Length	Comment
1	4,809.0	26-Mar-13 10:58:04	DCGS-G	1	OK	0.00	0.00	1.00	
2	4,805.0	26-Mar-13 10:59:13	DCGS-G	2	OK	0.00	0.00	1.00	
3	4,803.0	26-Mar-13 11:00:11	DCGS-G	3	OK	0.00	0.00	1.00	
4	4,795.0	26-Mar-13 11:00:57	DCGS-G	4	OK	0.00	0.00	1.00	
5	4,789.0	26-Mar-13 11:01:39	DCGS-G	5	OK	0.00	0.00	1.00	
6	4,783.0	26-Mar-13 11:02:37	DCGS-G	6	OK	0.00	0.00	1.00	
7	4,781.0	26-Mar-13 11:03:35	DCGS-G	7	OK	0.00	0.00	1.00	
8	4,779.0	26-Mar-13 11:04:26	DCGS-G	8	OK	0.00	0.00	1.00	
9	4,777.0	26-Mar-13 11:05:31	DCGS-G	9	OK	0.00	0.00	1.00	
10	4,775.0	26-Mar-13 11:06:27	DCGS-G	10	OK	0.00	0.00	1.00	
11	4,773.0	26-Mar-13 11:07:05	DCGS-G	11	OK	0.00	0.00	1.00	
12	4,771.0	26-Mar-13 11:07:40	DCGS-G	12	OK	0.00	0.00	1.00	
13	4,769.0	26-Mar-13 11:08:34	DCGS-G	13	OK	0.00	0.00	1.00	
14	4,767.0	26-Mar-13 11:09:20	DCGS-G	14	OK	0.00	0.00	1.00	
15	4,765.0	26-Mar-13 11:10:17	DCGS-G	15	OK	0.00	0.00	1.00	
16	4,763.0	26-Mar-13 11:11:19	DCGS-G	16	OK	0.00	0.00	1.00	
17	4,761.0	26-Mar-13 11:12:16	DCGS-G	17	OK	0.00	0.00	1.00	
18	4,759.0	26-Mar-13 11:13:15	DCGS-G	18	OK	0.00	0.00	1.00	
19	4,757.0	26-Mar-13 11:13:58	DCGS-G	19	OK	0.00	0.00	1.00	
20	4,755.0	26-Mar-13 11:14:50	DCGS-G	20	OK	0.00	0.00	1.00	
21	4,753.0	26-Mar-13 11:15:36	DCGS-G	21	OK	0.00	0.00	1.00	
22	4,719.0	26-Mar-13 11:16:42	DCGS-G	22	OK	0.00	0.00	1.00	
23	4,696.0	26-Mar-13 11:17:40	DCGS-G	23	OK	0.00	0.00	1.00	
24	4,640.0	26-Mar-13 11:19:05	DCGS-G	24	OK	0.00	0.00	1.00	

HALLIBURTON

TOOL STRING DIAGRAM REPORT

Description	Overbody Description	O.D.	Diagram	Sensors @ Delays	Length	Accumulated Length
						38.94 ft
RWCH-10550946 135.00 lbs		Ø 3.625 in		Load Cell @ 35.26 ft BH Temperature @ 34.69 ft	6.25 ft	
						32.69 ft
				GammaRay @ 31.01 ft		
D4TGX-X029 221.00 lbs		Ø 3.625 in			9.63 ft	
				Z-Accelerometer @ 24.28 ft		
						23.06 ft
Spacer-00000082 250.00 lbs		Ø 3.625 in			10.10 ft	
						12.96 ft
		Ø 4.060 in				
DCGS-G-00000013 430.00 lbs		Ø 4.060 in		Top Core Barrel @ 6.29 ft	12.96 ft	
				Bottom Core Barrel @ 0.54 ft		
						0.00 ft

Mnemonic	Tool Name	Serial Number	Weight (lbs)	Length (ft)	Accumulated Length (ft)	Max.Log. Speed (fpm)
RWCH	Releasable Wireline Cable Head	10550946	135.00	6.25	32.69	300.00
D4TGX	DITS Telemetry Gamma - Gibraltar Class	X029	221.00	9.63	23.06	60.00
SPC	ISO	00000082	250.00	10.10	12.96	100.00
DCGS	Digital Core Gun - Gearhart Gun w/o Centralizer	00000013	430.00	12.96	0.00	300.00

Total	**1,036.00**	**38.94**

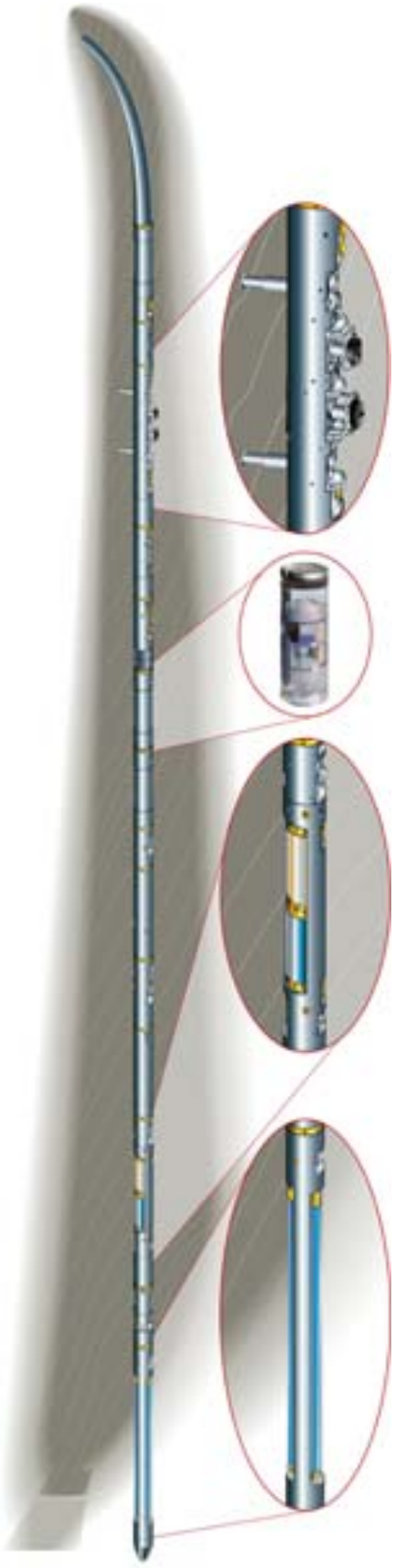
Data: PIACENTINE 2-27\0005 SWC_PGE\IDLE **Date: 26-Mar-13 11:56:58**

COMPANY	**PG&E**		
WELL	**PIACENTINE 2-27**		
FIELD	**KING ISLANDS GAS**		
COUNTY	**SAN JOAQUIN**	STATE	**CA**

HALLIBURTON

SIDE WALL CORE

5"=100'



RDT Pressure Transient Analysis

Client: PG&E
Well: PIACENTINE 2-27
Field: KING ISLANDS
GAS
Rig:
Country: USA

Logged:

Analyst: C. HARRELL
Date: 03/26/13

HALLIBURTON

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Test No. 9.0; MD: 4804.00 ft; TVD: 4804.00 ft 26
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Test No. 10.0; MD: 4810.02 ft; TVD: 4810.02 ft 28
Test No. 10.1; MD: 4810.02 ft; TVD: 4810.02 ft 29
Test No. 11.0; MD: 4880.01 ft; TVD: 4880.01 ft 30
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Overview

At the request of PG&E, the RDT tool was run in the PIACENTINE 2-27 well, KING ISLANDS GAS field, USA in a 8.5 in. hole for formation pressures and establishes gradients in various formations.

Log Header

HALLIBURTON

RESVERVOIR DESCRIPTION TOOL (RDT-A)

COMPANY	PG&E
WELL	PIACENTINE 2-27
FIELD	KING ISLANDS GAS
COUNTY	SAN JOAQUIN
STATE	CA

COMPANY PG&E
WELL PIACENTINE 2-27
FIELD KING ISLANDS GAS
COUNTY SAN JOAQUIN STATE CA

API No. 04-077-20736
Location LAT: 38.08155572
LONG:121.422162329

Sect. 27 Twp. 3N Rge. 5E

Other Services:
ACRT/SDL/DSNT
XRMC/SNGI
BSAT
ICT
MRIL
SWC
JARS

Permanent Datum	GL	Elev.: -4.5 ft	Elev.: K.B. 7.5 ft
Log measured from	KB	12.0 ft above perm. Datum	D.F. 0.0 ft
Drilling measured from	KB		G.L. -4.5 ft
Date	25-Mar-13		
Run No.	5		
Number of Tests	12		
Depth - Driller	4870.00 ft		
Casing Size	9.625 in		
Casing - Driller	613.0 ft		
Bit Size	8.500 in	@	@
Type Fluid in Hole	LSND		
Density	10.2 ppg		
Viscosity	38.00 sqt		
PH	8.00 pH		
Fluid Loss	3.9 cpim		
Source of Sample	FLOWLINE		
Rm @ Meas. Temperature	3.400 ohmm @ 72.00 degF	@	@
Rmf @ Meas. Temperature	2.71 ohmm @ 69.00 degF	@	@
Rmc @ Meas. Temperature	4.620 ohmm @ 69.00 degF	@	@
Source Rmf / Rmc	MEAS / MEAS		
Max. Rec. Temperature	123.0 degF @	@	@
Tool Type	RDTA		
Time Since Circulation	31.7 hr		
Equipment	11871069		
Equipment Location	BKSFLD		
Recorded By	D. ROMERO	B. WYRICK	C. HARRELL
Witnessed By	FRANK B. CRESSY		

Fold here

Service Ticket No.: 900310522 API Serial No.: 04-077-20736 PGM Version: WL INSITE R3.4.2 (Build 2)

DIRECTIONAL INFORMATION

Maximum Deviation @ KOP @

Remarks:

1. DEPTH CORRELATED TO HES RUN 1.
2. PROBE 1:0.328 RADIUS W18 MICRON SCREEN. HYDROSTATIC PROBE 4.25" RADIUS PAD
3. PROBE 2:0.328 RADIUS W18 MICRON SCREEN. HYDROSTATIC PROBE 4.25" RADIUS PAD
4. RDT RAN WITH STANDARD HOLE CONFIGURATION
5. 4K PUMP RUN IN FPS
6. FLID USED FOR CONTAMINATION ANALYSIS
7. FILLED THREE STANDARD CHAMBERS AT 4774'. SAMPLES DOWNLOADED ON SURFACE AND DELIVERED TO LAB FOR ANALYSIS.

CREW: F. VARGAS, B. CONTRERAS, A. VAZQUEZ RIG: PG 4

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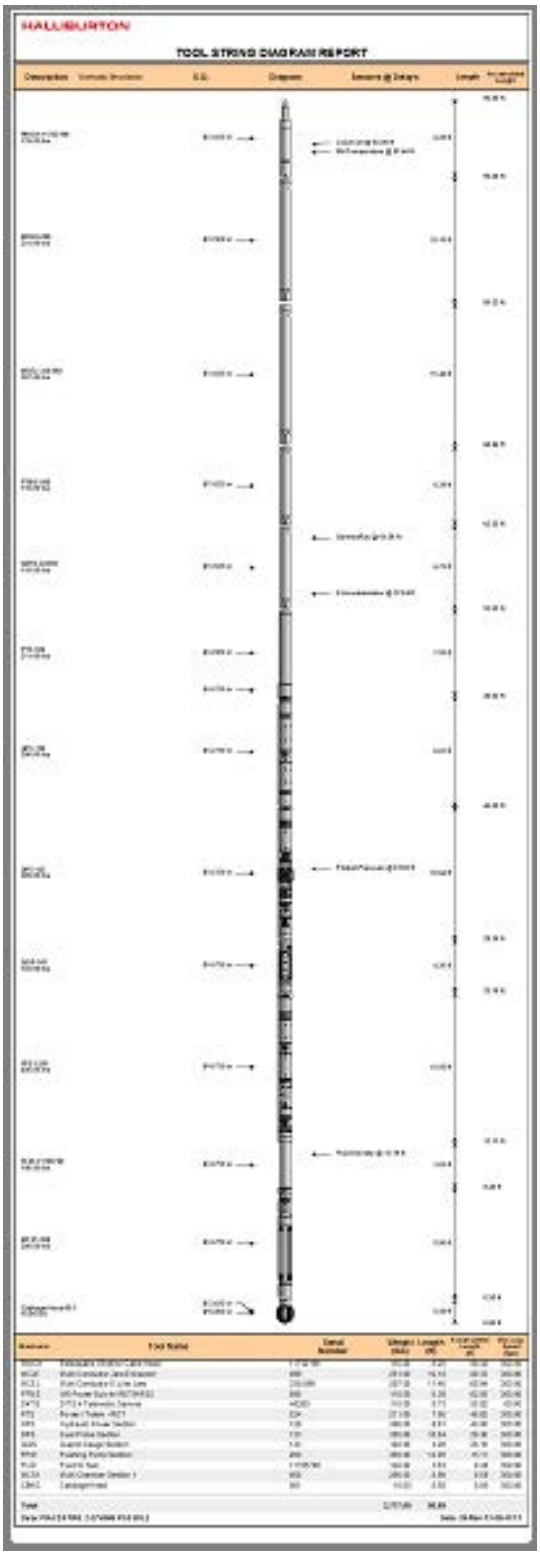
Tool String Diagram



Test Summary

PRESSURE TEST SUMMARY															
Test Identification				Hydrostatic Pres.		Eq. Mud Wt.		Test Pressures - Temperatures					Test Times		Remarks
Test No.	File No.	MD (ft)	TVD (ft)	Phyds1 (psia)	Phyds2 (psia)	EqFmMw (lbs/gal)	EqBhMw (lbs/gal)	Psdd (psia)	Pedd (psia)	Pstop (psia)	dPob (psia)	Temp (degF)	dTdd (sec)	dTbu (sec)	
1.1	5-4.1	4630.06	4630.06	2523.76	2521.43	8.40	10.47	2023.08	1999.73	2021.65	499.79	118.50	1.00	105.62	Excellent Buildup Stability
2.1	5-5.1	4695.01	4695.00	2557.33	2555.31	7.82	10.47	1908.98	1852.09	1908.98	646.33	118.80	0.75	82.35	Excellent Buildup Stability
3.1	5-6.1	4720.04	4720.04	2570.71	2568.03	7.82	10.46	1919.21	1731.42	1920.06	647.97	119.20	1.50	118.64	Good Buildup Stability
4.1	5-7.1	4754.05	4754.05	2587.26	2585.76	7.83	10.46	1934.58	1915.42	1934.50	651.26	119.60	0.75	83.31	Excellent Buildup Stability
5.1	5-8.1	4762.00	4762.00	2590.06	2589.16	7.83	10.46	1937.93	1907.49	1937.94	651.22	120.00	4.25	82.75	Excellent Buildup Stability
6.1	5-16.1	4774.00	4774.00	2599.36	2574.01	7.83	10.37	1943.91	1935.19	1943.78	630.23	129.60	0.50	36.50	Excellent Buildup Stability
7.1	5-9.1	4774.01	4774.01	2596.45	2597.04	7.83	10.46	1943.22	1909.36	1943.08	653.95	120.20	2.00	82.05	Excellent Buildup Stability
8.1	5-10.1	4788.02	4788.02	2606.30	2604.60	7.83	10.46	1949.24	1914.98	1949.21	655.39	120.50	2.00	90.82	Excellent Buildup Stability
9.1	5-11.1	4793.99	4793.99	2607.17	2607.07	7.83	10.46	1951.93	1939.84	1951.75	655.32	121.20	1.00	93.25	Excellent Buildup Stability
10.1	5-12.1	4804.00	4804.00	2612.65	2612.16	7.83	10.46	1956.23	1910.19	1956.14	656.02	121.50	1.50	91.25	Excellent Buildup Stability
11.1	5-13.1	4810.02	4810.02	2615.83	2614.84	7.83	10.45	1958.87	1945.29	1958.78	656.06	121.60	2.00	97.35	Excellent Buildup Stability
12.1	5-14.1	4880.01	4880.01	2655.59	2653.02	7.84	10.45	1989.55	1942.30	1989.77	663.26	122.40	1.50	108.37	Excellent Buildup Stability
13.1	5-15.1	4890.02	4890.02	2660.62	2659.93	7.84	10.46	1994.03	1952.88	1994.05	665.88	122.70	1.75	89.33	Excellent Buildup Stability

Legend:
Phyds1: Initial Hydrostatic Pressure
Phyds2: Final Hydrostatic Pressure
EqFmMw:Equivalent Formation Mud Weight (Pstop / (TVD * Constant))
EqBhMw: Equivalent Borehole Mud Weight (Phyds2 / (TVD * Constant))
Psdd: Initial Drawdown Pressure
Pedd: Final Drawdown or End Drawdown Pressure
Pstop: Final Buildup Pressure
Temp: Final Temperature
dTdd= Tedd-Tsdd: Tedd - End of Drawdown Time; Tsdd - Initial Drawdown Time
dTbu=Tstop - Tedd:Buildup Time, Tedd - End of Drawdown Time, Tstop - Final Buildup Time
dPob= Phyds2 - Pstop: Over Balance

PRESSURE TRANSIENT SUMMARY										
Test Identification				Buildup Stability		PTA Pressure		PTA Mobilities		Remarks
Test No.	File No.	MD (ft)	TVD (ft)	Stability (psia/min)	Stability (degF/min)	Pexact (psia)	Pstdev (psia)	Mexact (md/cp)	Msdd (md/cp)	
1.1	5-4.1	4630.06	4630.06	-0.005		2021.65	0.01	72.5	228	Excellent Buildup Stability
2.1	5-5.1	4695.01	4695.00	0.039		1908.98	0.04	17.4	57.4	Excellent Buildup Stability
3.1	5-6.1	4720.04	4720.04	0.362		1920.06	0.14	16.6	36.2	Good Buildup Stability
4.1	5-7.1	4754.05	4754.05	-0.011		1934.50	0.02	82.4	381	Excellent Buildup Stability
5.1	5-8.1	4762.00	4762.00	-0.006		1937.94	0.01	533	533	Excellent Buildup Stability
6.1	5-16.1	4774.00	4774.00	-0.001		1943.78	0.01	323	1160	Excellent Buildup Stability
7.1	5-9.1	4774.01	4774.01	-0.020		1943.08	0.01	283	337	Excellent Buildup Stability
8.1	5-10.1	4788.02	4788.02	-0.014		1949.21	0.01	400	405	Excellent Buildup Stability
9.1	5-11.1	4793.99	4793.99	-0.013		1951.75	0.01	226	793	Excellent Buildup Stability
10.1	5-12.1	4804.00	4804.00	0.001		1956.14	0.09	82.2	266	Excellent Buildup Stability
11.1	5-13.1	4810.02	4810.02	-0.025		1958.78	0.06	713	984	Excellent Buildup Stability
12.1	5-14.1	4880.01	4880.01	0.010		1989.77	0.02	101	135	Excellent Buildup Stability
13.1	5-15.1	4890.02	4890.02	-0.022		1994.05	0.01	333	339	Excellent Buildup Stability

Legend:
Pexact: Projected formation pressure based on exact model.
Pstdev: Standard deviation of actual pressures from exact model
Mexact: Spherical Mobility based on exact model
Msdd: Spherical Drawdown Mobility

SAMPLE SUMMARY

Sample Identification				Conditions					Fluid Properties*			Pumpout - Anisotropy**			Remarks
Sample Test	File No.	MD (ft)	Event	Ts (sec)	Ps (psia)	Pop (psia)	Vs (cc)	Temp (degF)	Density (sg)*	B.P. (psia)	Com. (1/psia)	Mposph (md/cp)	Mpoh (md/cp)	ANISO (Kv/Kh)	
6.1	5-16.1	4774.00	OpenSc	48398.25	1930.98	2612.30		129.20	0.98			50.60			SN 1498 STANDARD CHAMBER
6.2	5-16.2	4774.00	OpenSc	56245.50	1925.96	2624.86		129.40	0.98			2282.31			SN 1500 STANDARD CHAMBER
6.3	5-16.3	4774.00	OpenSc	57006.00	1926.25	2623.39		129.50	0.99			2343.43			SN 1507 STANDARD CHAMBER

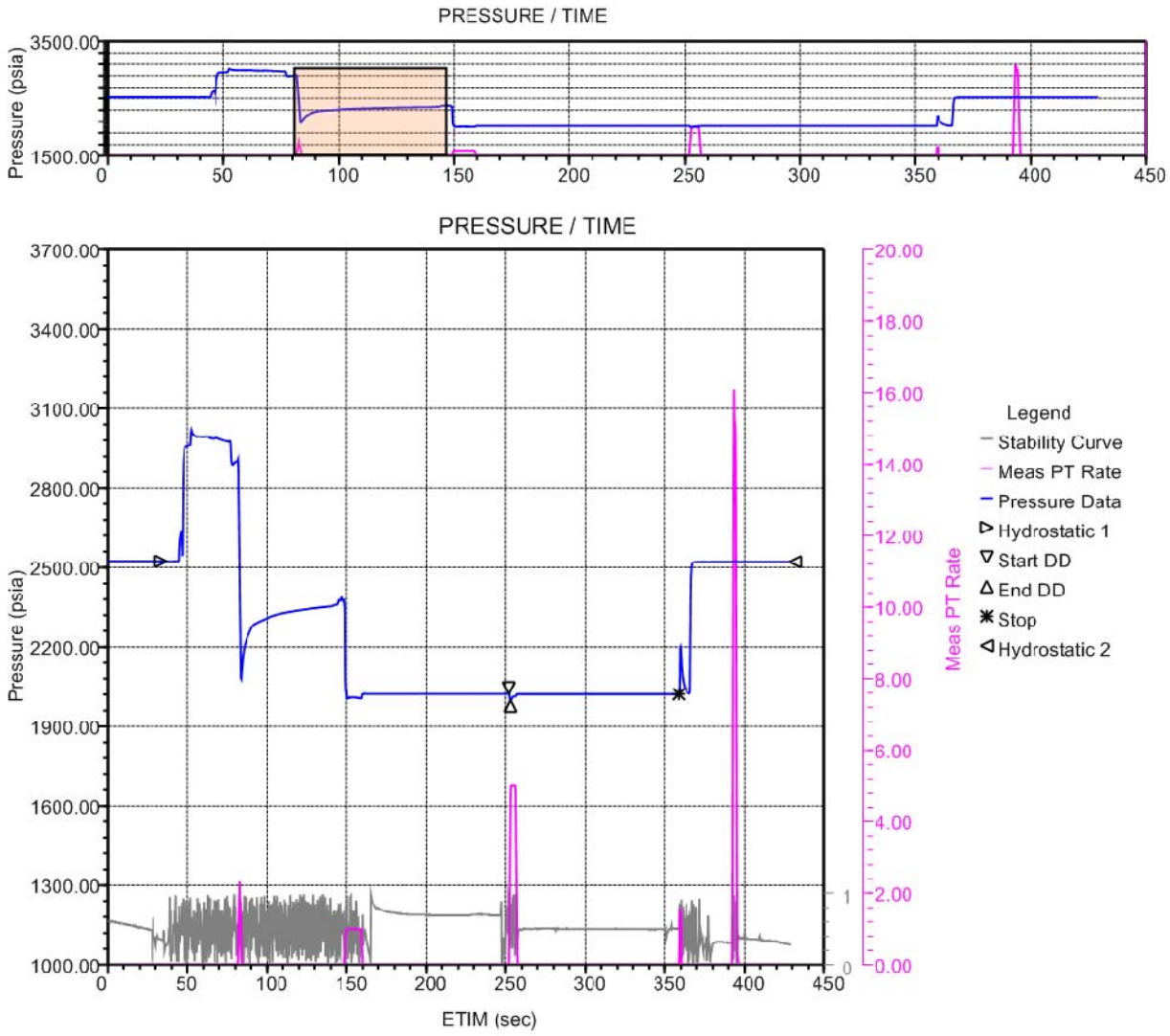
Legend:
Ts: Time Sample Taken
Ps: Pressure of Sample
B.P.:Bubble Point Pressure
Temp: Pretest Temperature
Com.: Compressibility
Density: Density
Pop: Over Pressure
Vs: Sample Volume
Mposph: Pump out Spherical Mobility
Mpoh: Pump out Horizontal Mobility
ANISO: Anisotropy, Kv/Kh

Options:
*: Fluid density available with advanced fluid properties tool option
**: Permeability - Mposph, Mpoh is available with pump-out and advanced fluid properties option

Plots

Test No. 1.0; MD: 4630.06 ft; TVD: 4630.06 ft

RDT Test File # 5-4.0 Date: 26-Mar-13 00:44:45



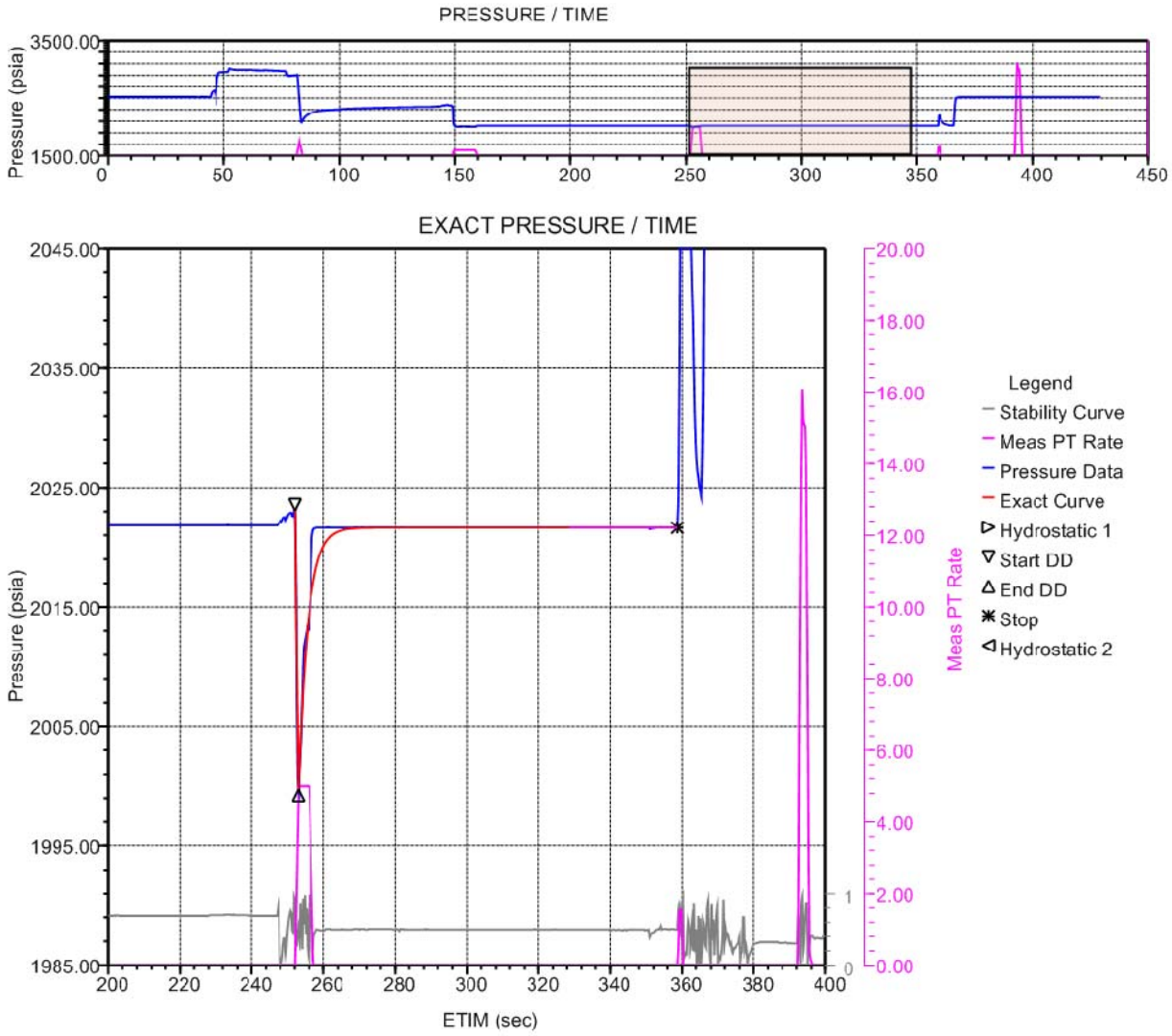
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4630.06	2523.42	2521.43							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
2.60	2.60	0.66	0.25	3.28e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 1.1; MD: 4630.06 ft; TVD: 4630.06 ft

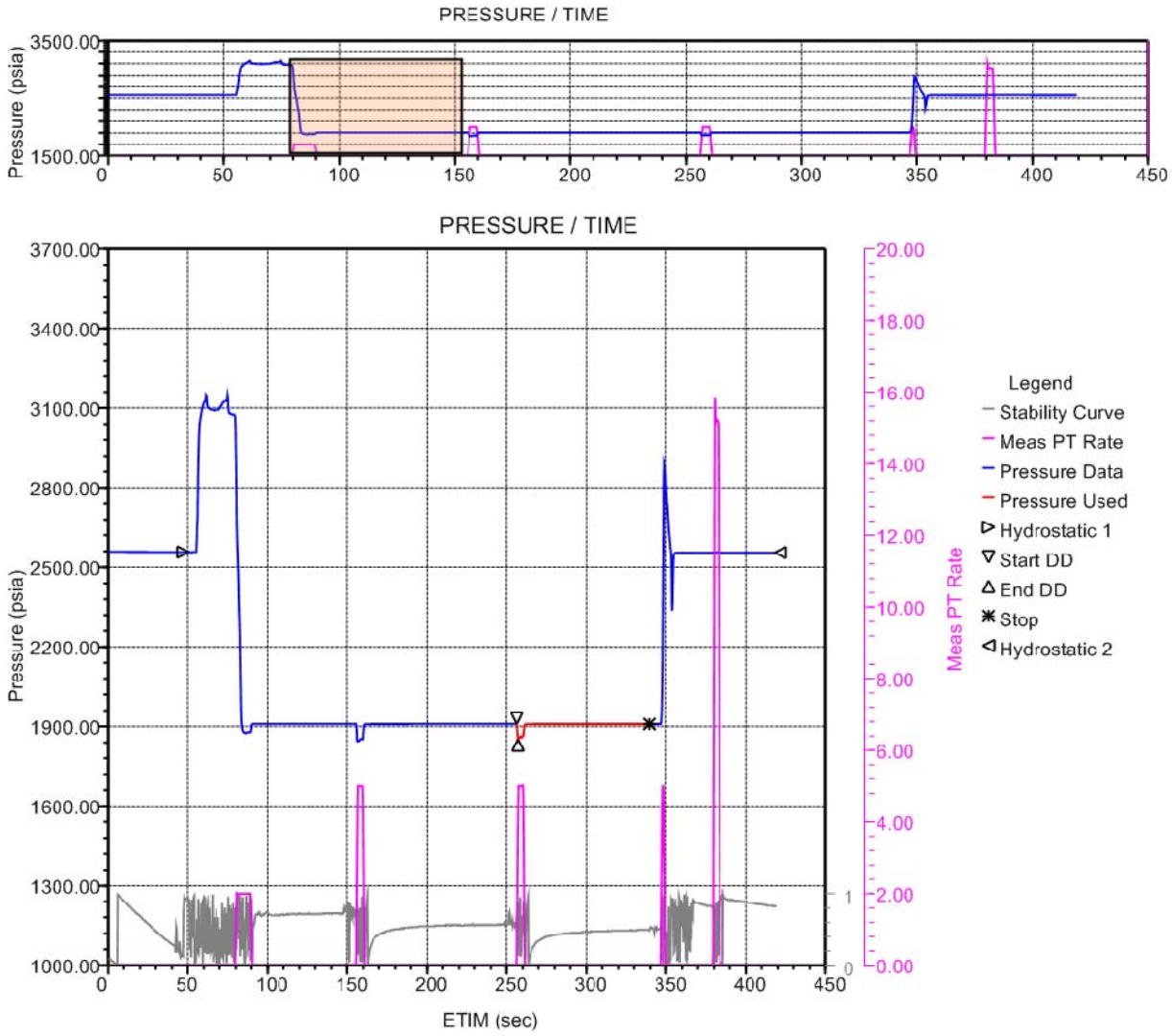
RDT Test File # 5-4.1 Date: 26-Mar-13 00:44:45



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4630.06	4630.06	1999.73	2021.65	2021.65	72.5
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
2.60	2.60	0.66	0.25	3.28e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.01	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 2.2; MD: 4695.01 ft; TVD: 4695.00 ft

RDT Test File # 5-5.2 Date: 26-Mar-13 00:56:29



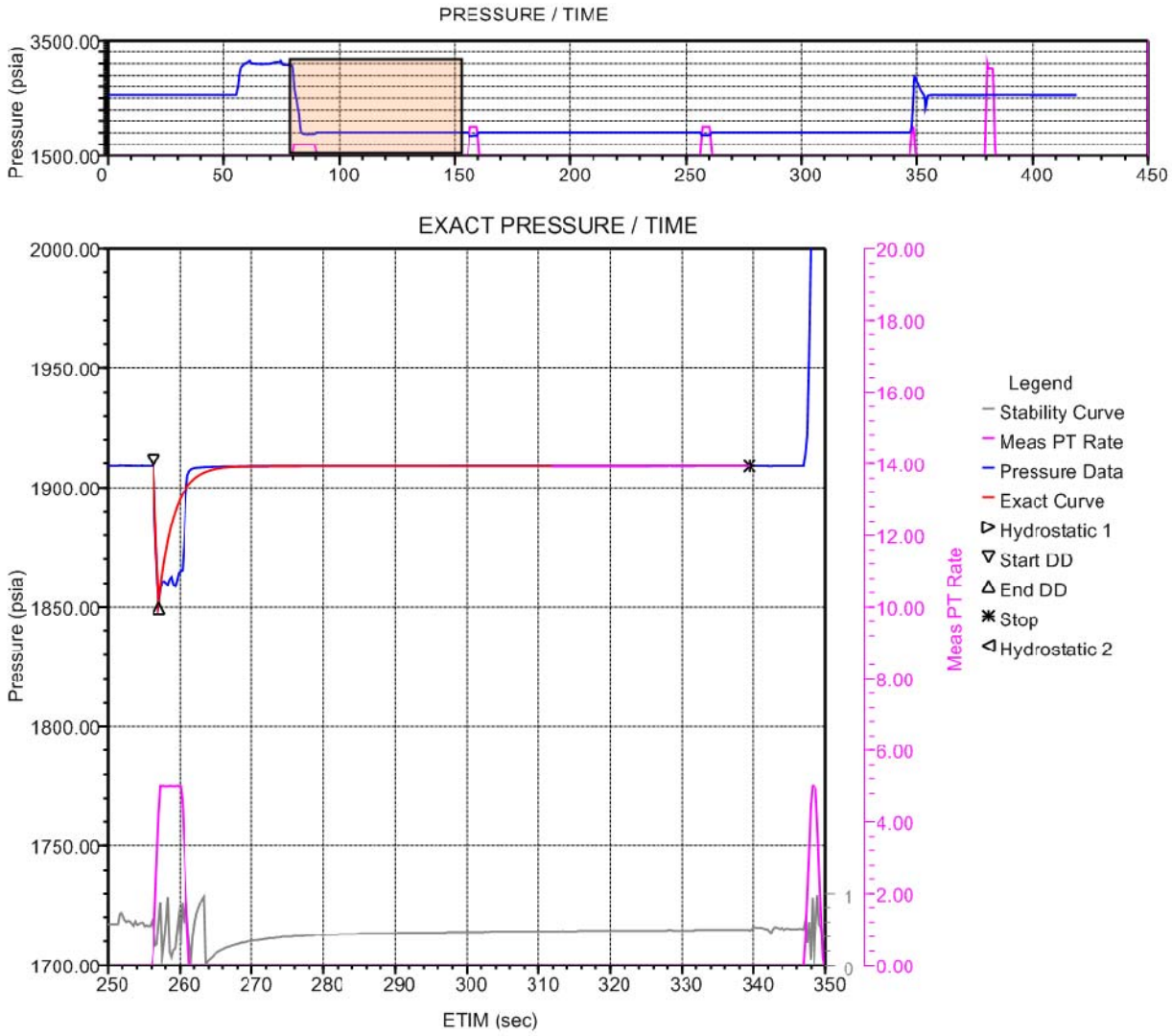
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4695.01	2557.33	2555.32	1908.98	1852.09	1908.98	256.31	257.06	339.40	57.4

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
1.28	1.70	0.66	0.25	9.37e-005	180.00

REMARKS
Excellent Buildup Stability

Test No. 2.2; MD: 4695.01 ft; TVD: 4695.00 ft

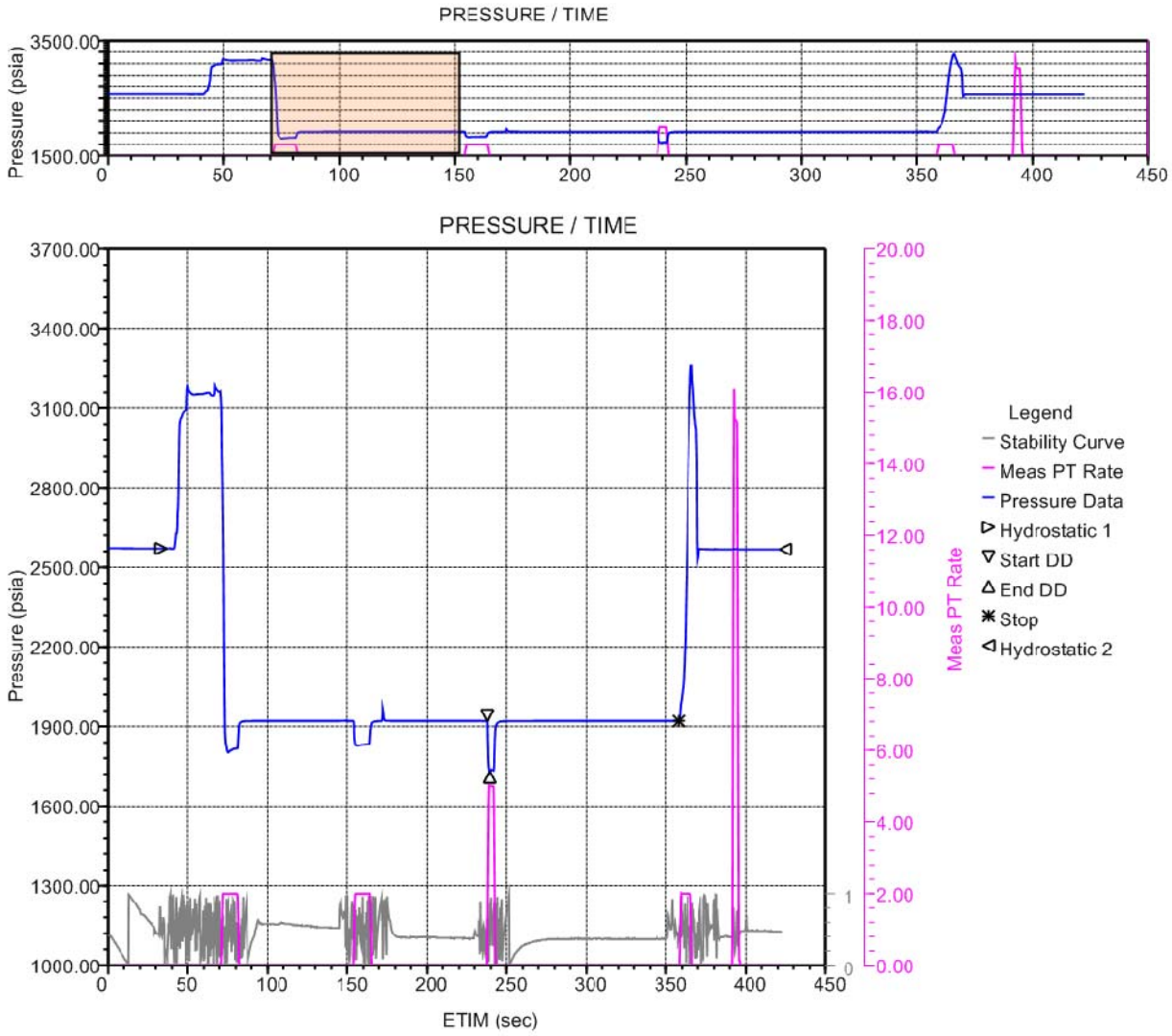
RDT Test File # 5-5.2 Date: 26-Mar-13 00:56:29



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4695.01	4695.00	1852.09	1908.98	1908.98	17.4
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
1.28	1.70	0.66	0.25	9.37e-005	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.04	0.04	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 3.0; MD: 4720.04 ft; TVD: 4720.04 ft

RDT Test File # 5-6.0 Date: 26-Mar-13 01:06:31



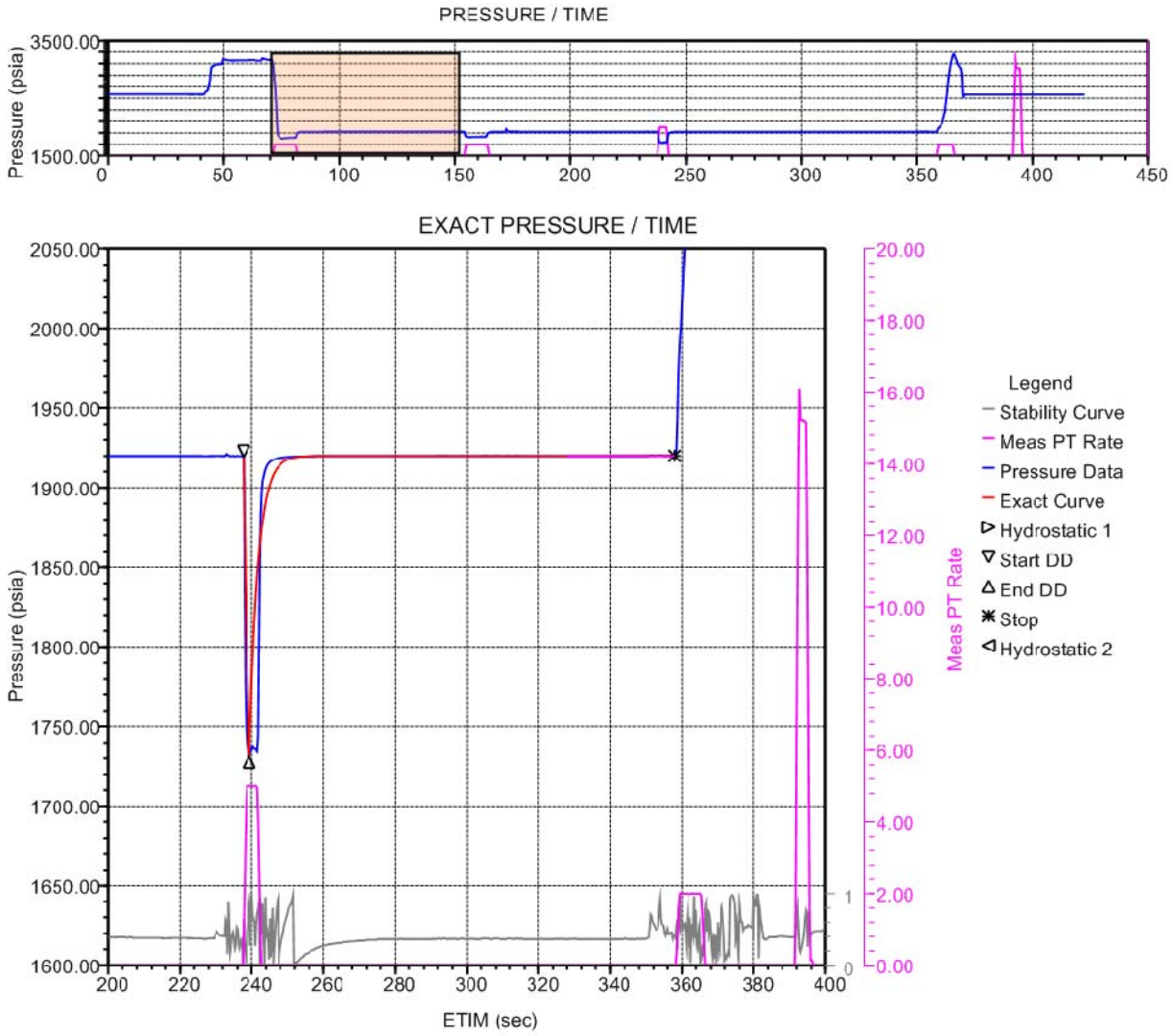
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4720.04	2570.71	2568.03							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
5.33	3.55	0.66	0.25	5.53e-005	180.00

REMARKS
Good Buildup Stability

Test No. 3.1; MD: 4720.04 ft; TVD: 4720.04 ft

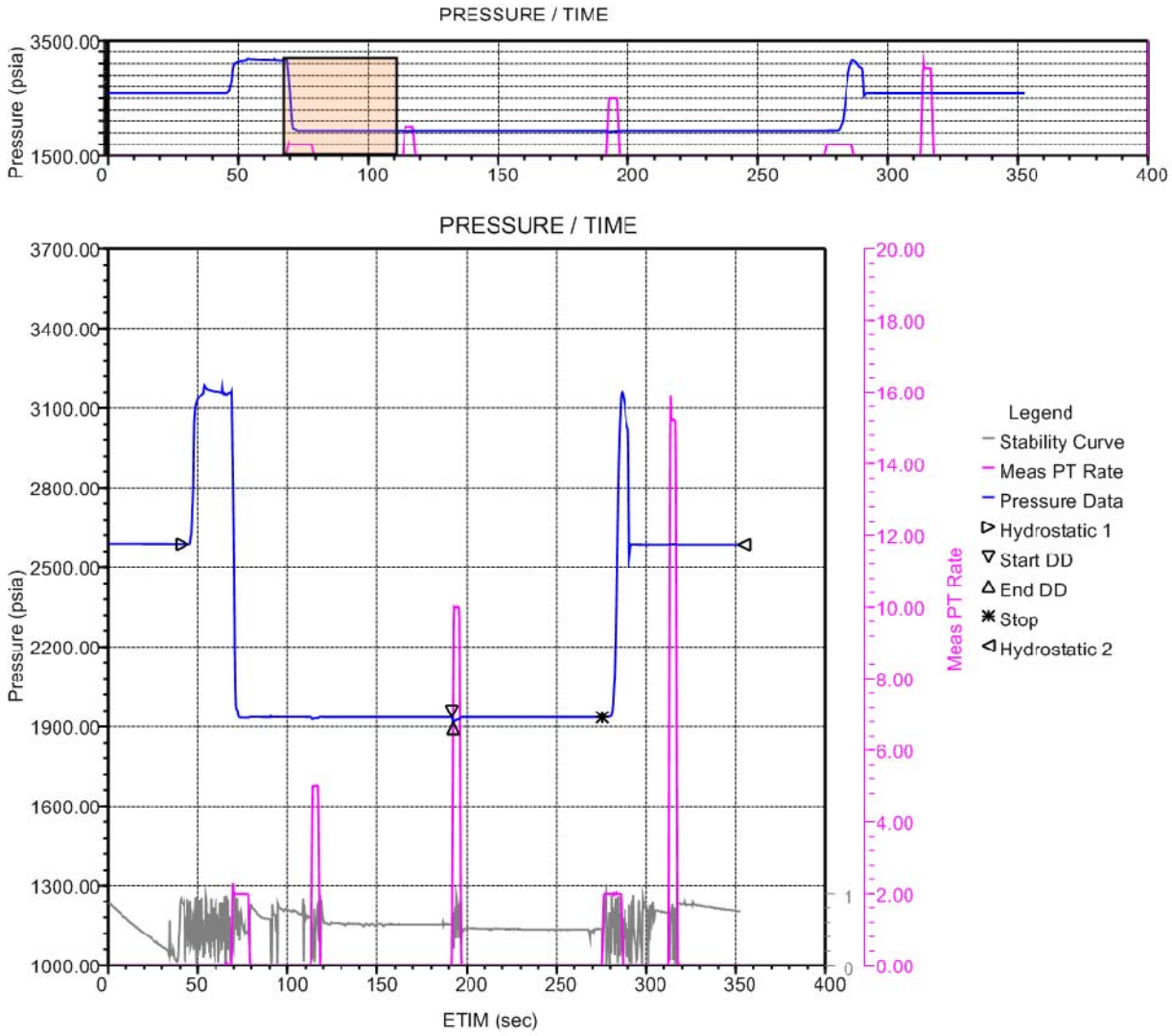
RDT Test File # 5-6.1 Date: 26-Mar-13 01:06:31



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4720.04	4720.04	1731.42	1920.06	1920.06	16.6
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
5.33	3.55	0.66	0.25	5.53e-005	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.14	0.36	0.00			
REMARKS					
Good Buildup Stability					

Test No. 4.0; MD: 4754.05 ft; TVD: 4754.05 ft

RDT Test File # 5-7.0 Date: 26-Mar-13 01:17:09



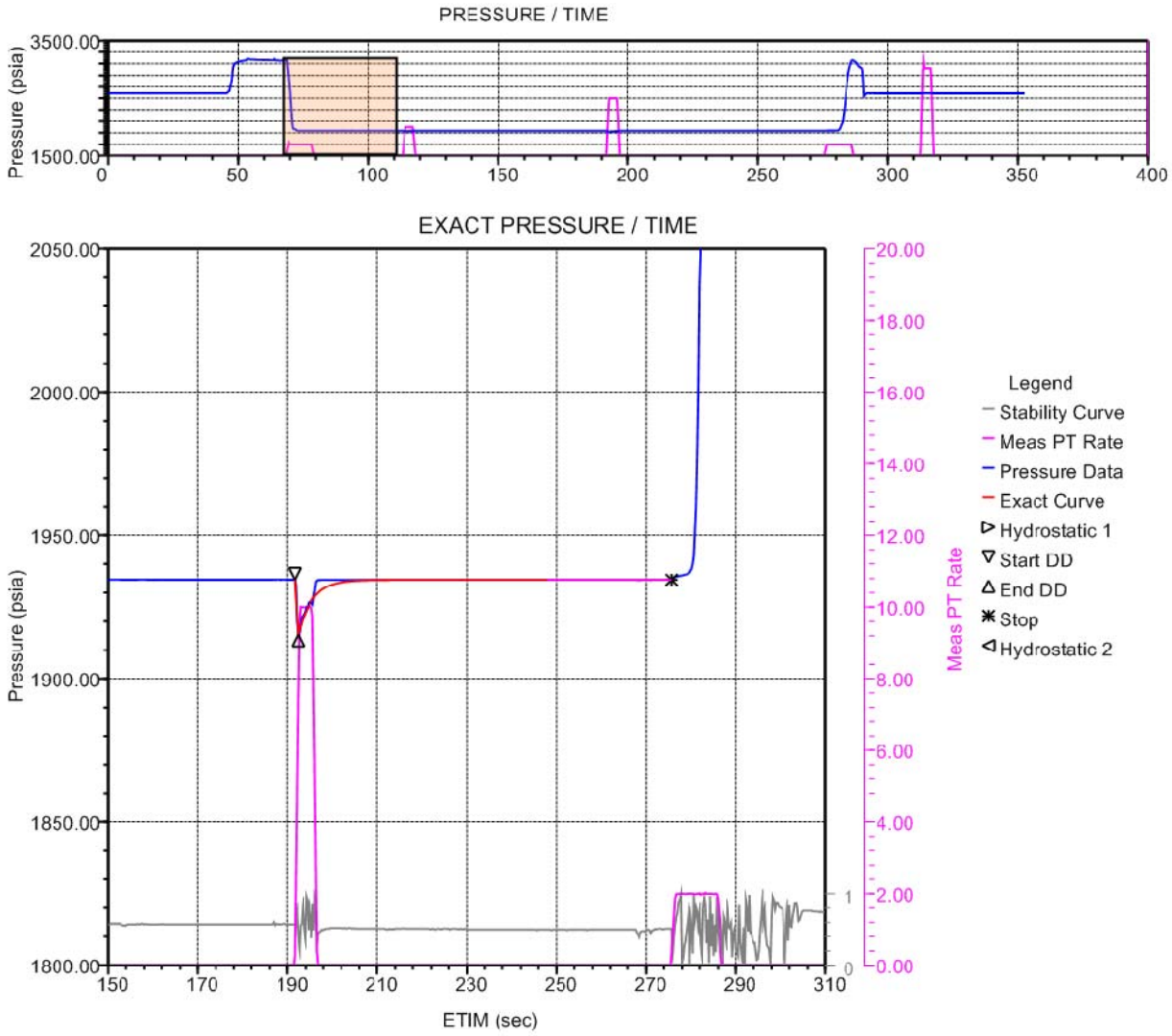
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4754.05	2587.26	2585.76							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
2.84	3.78	0.66	0.25	4.10e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 4.1; MD: 4754.05 ft; TVD: 4754.05 ft

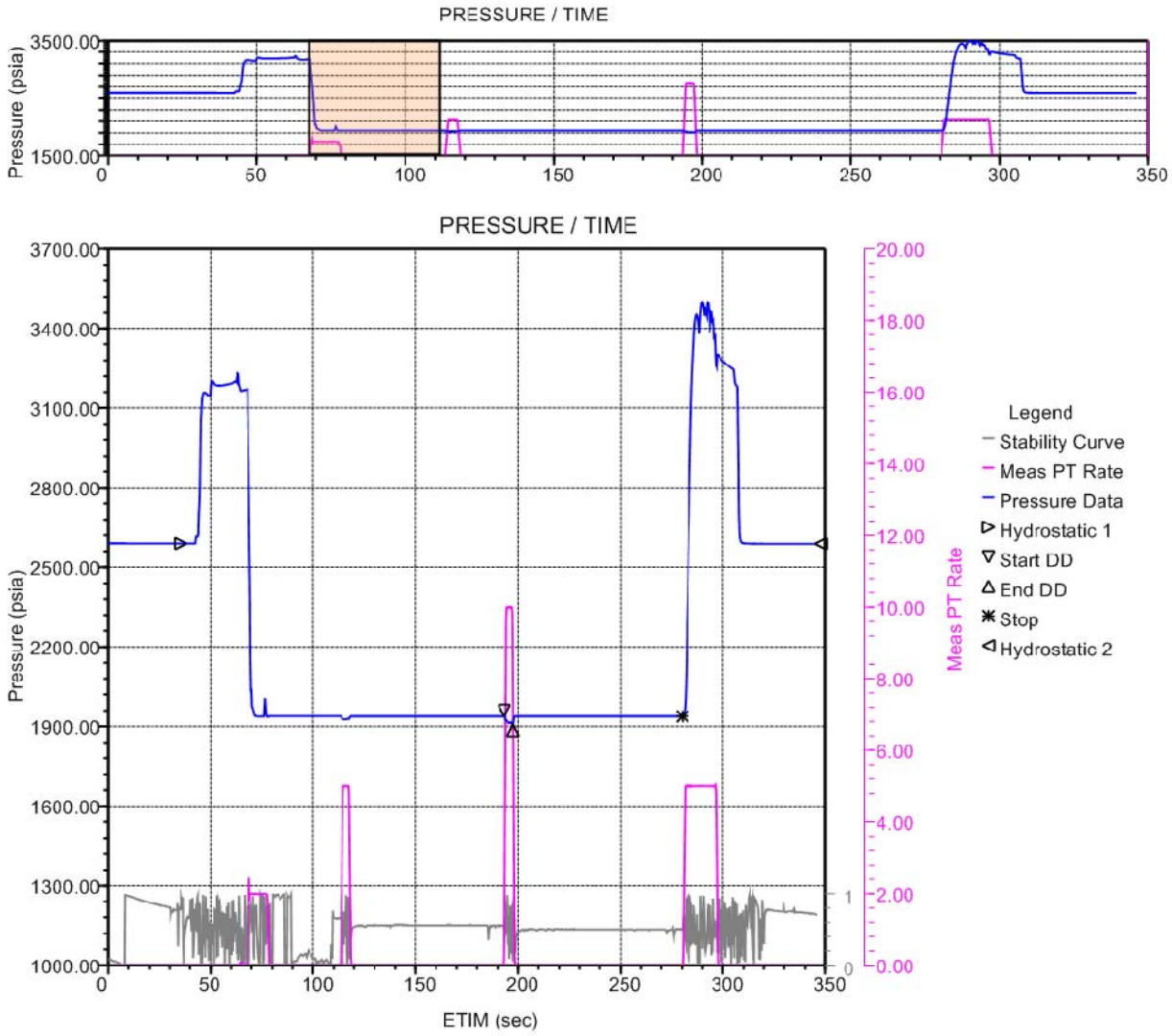
RDT Test File # 5-7.1 Date: 26-Mar-13 01:17:09



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4754.05	4754.05	1915.42	1934.50	1934.50	82.4
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
2.84	3.78	0.66	0.25	4.10e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.02	-0.01	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 5.0; MD: 4762.00 ft; TVD: 4762.00 ft

RDT Test File # 5-8.0 Date: 26-Mar-13 01:25:20



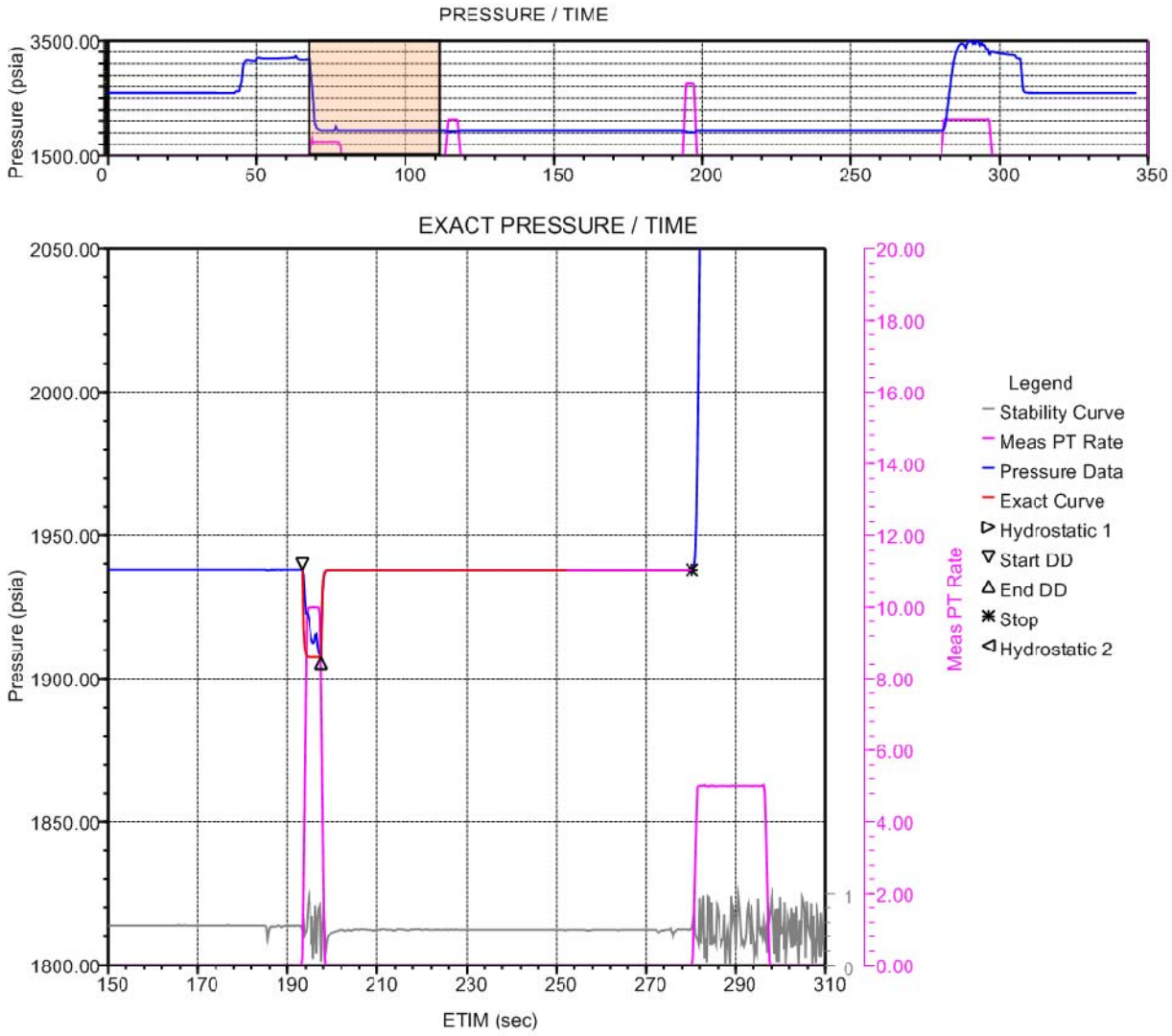
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4762.00	2590.06	2589.16							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
35.92	8.45	0.66	0.25	1.63e-003	180.00

REMARKS
Excellent Buildup Stability

Test No. 5.1; MD: 4762.00 ft; TVD: 4762.00 ft

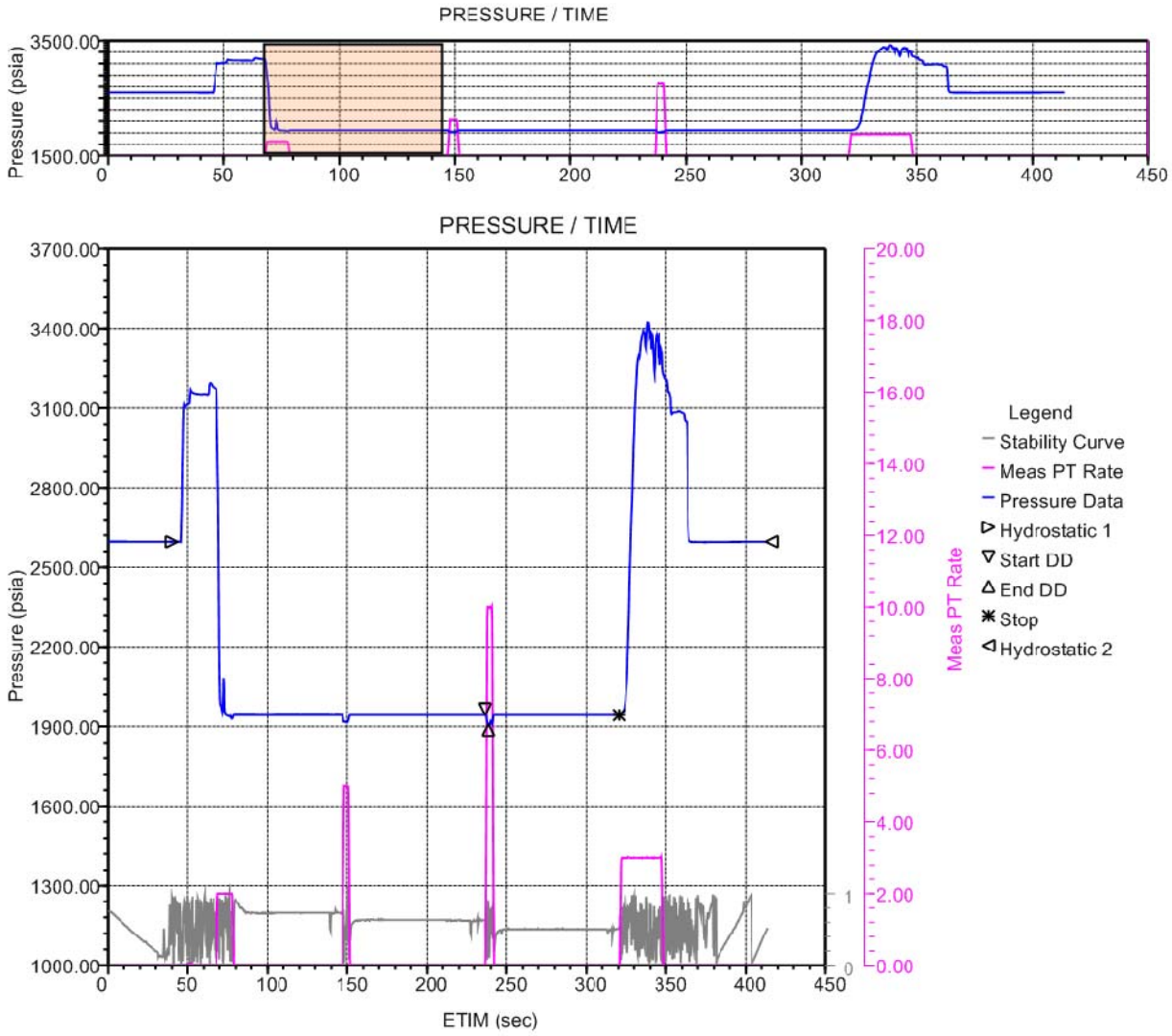
RDT Test File # 5-8.1 Date: 26-Mar-13 01:25:20



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4762.00	4762.00	1907.49	1937.94	1937.94	533
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
35.92	8.45	0.66	0.25	1.63e-003	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.01	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 6.0; MD: 4774.01 ft; TVD: 4774.01 ft

RDT Test File # 5-9.0 Date: 26-Mar-13 01:32:53



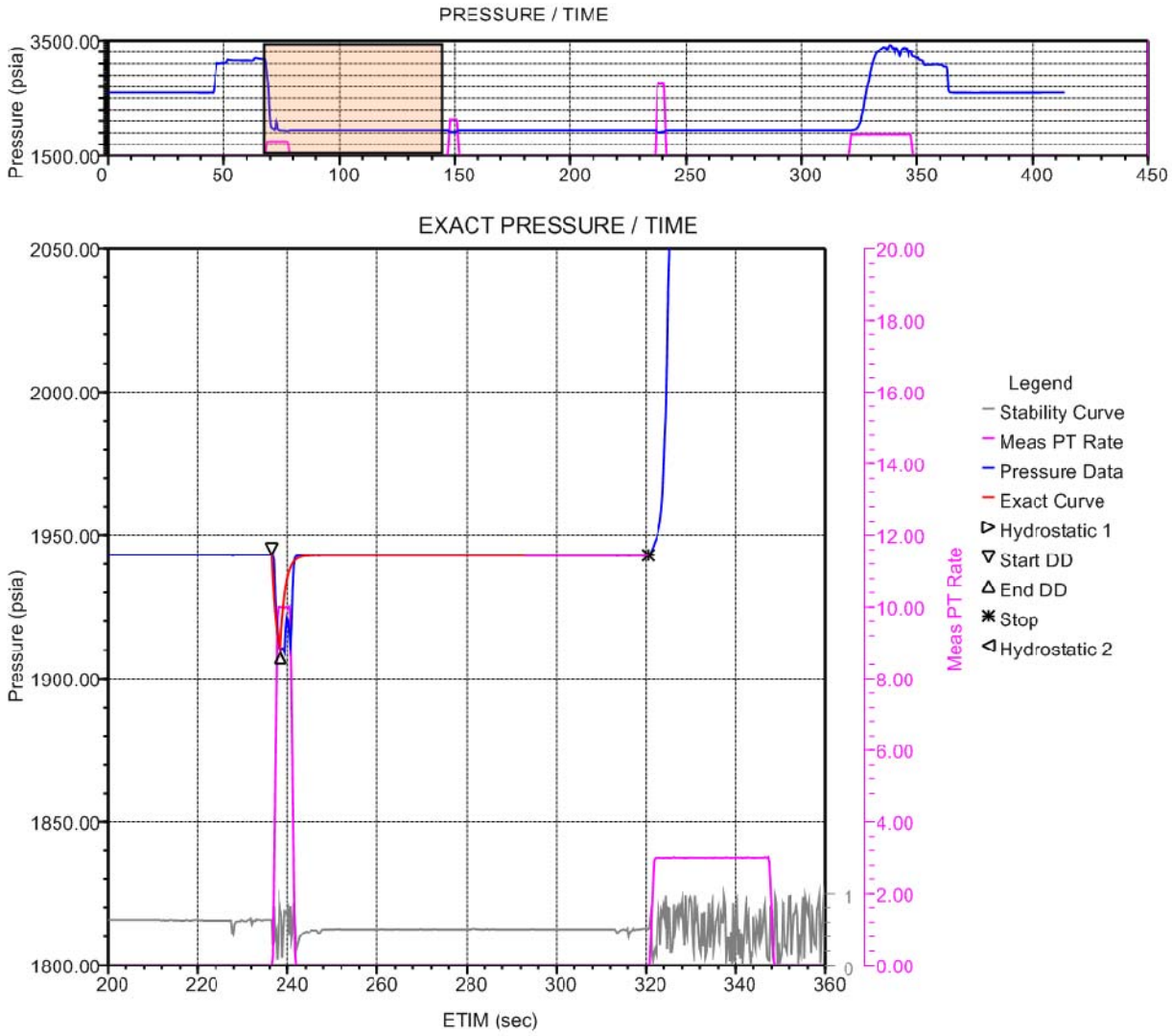
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4774.01	2596.45	2597.04							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
11.85	5.92	0.66	0.25	7.19e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 6.1; MD: 4774.01 ft; TVD: 4774.01 ft

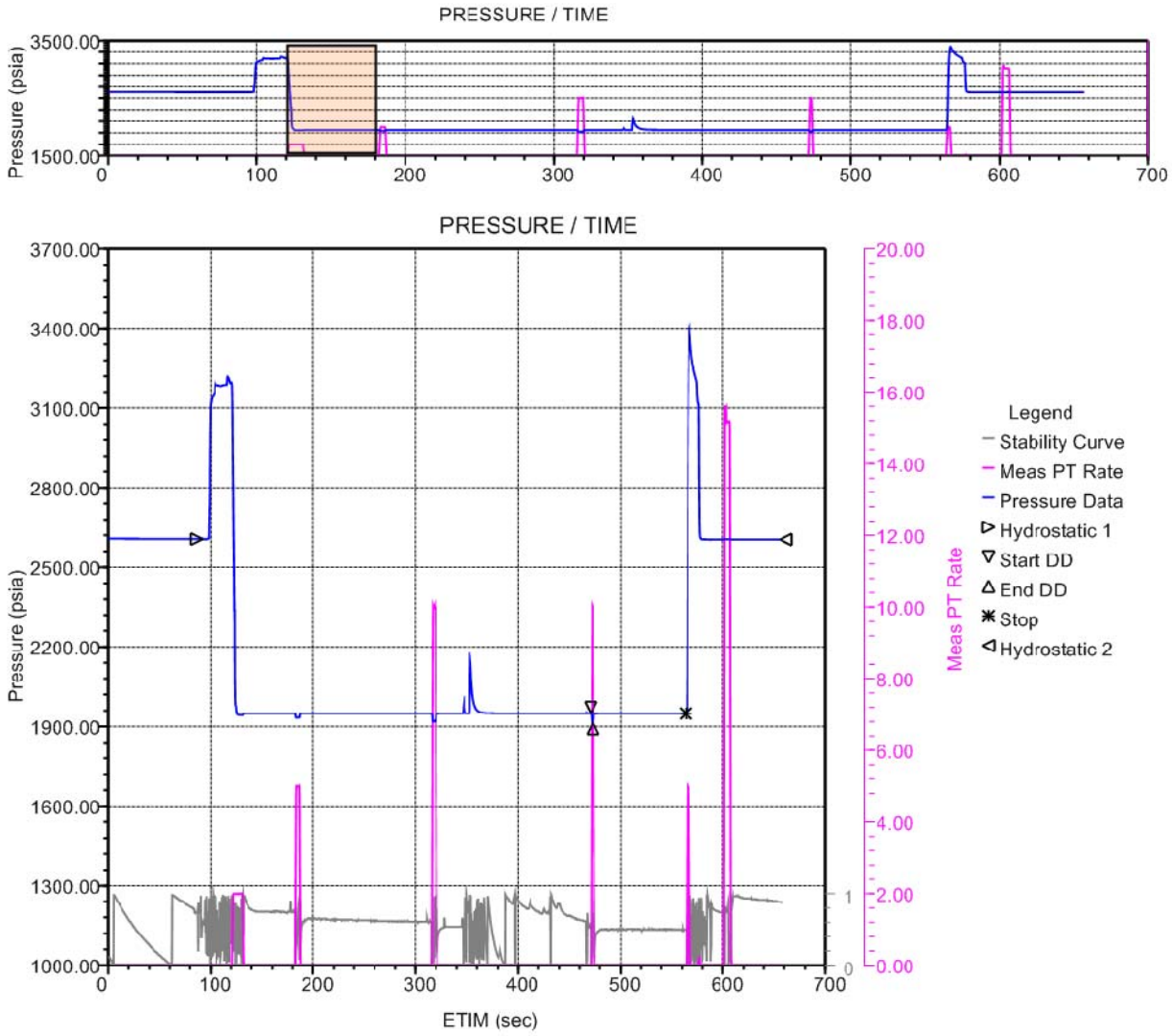
RDT Test File # 5-9.1 Date: 26-Mar-13 01:32:53



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4774.01	4774.01	1909.36	1943.08	1943.08	283
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
11.85	5.92	0.66	0.25	7.19e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.02	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 7.0; MD: 4788.02 ft; TVD: 4788.02 ft

RDT Test File # 5-10.0 Date: 26-Mar-13 01:41:34



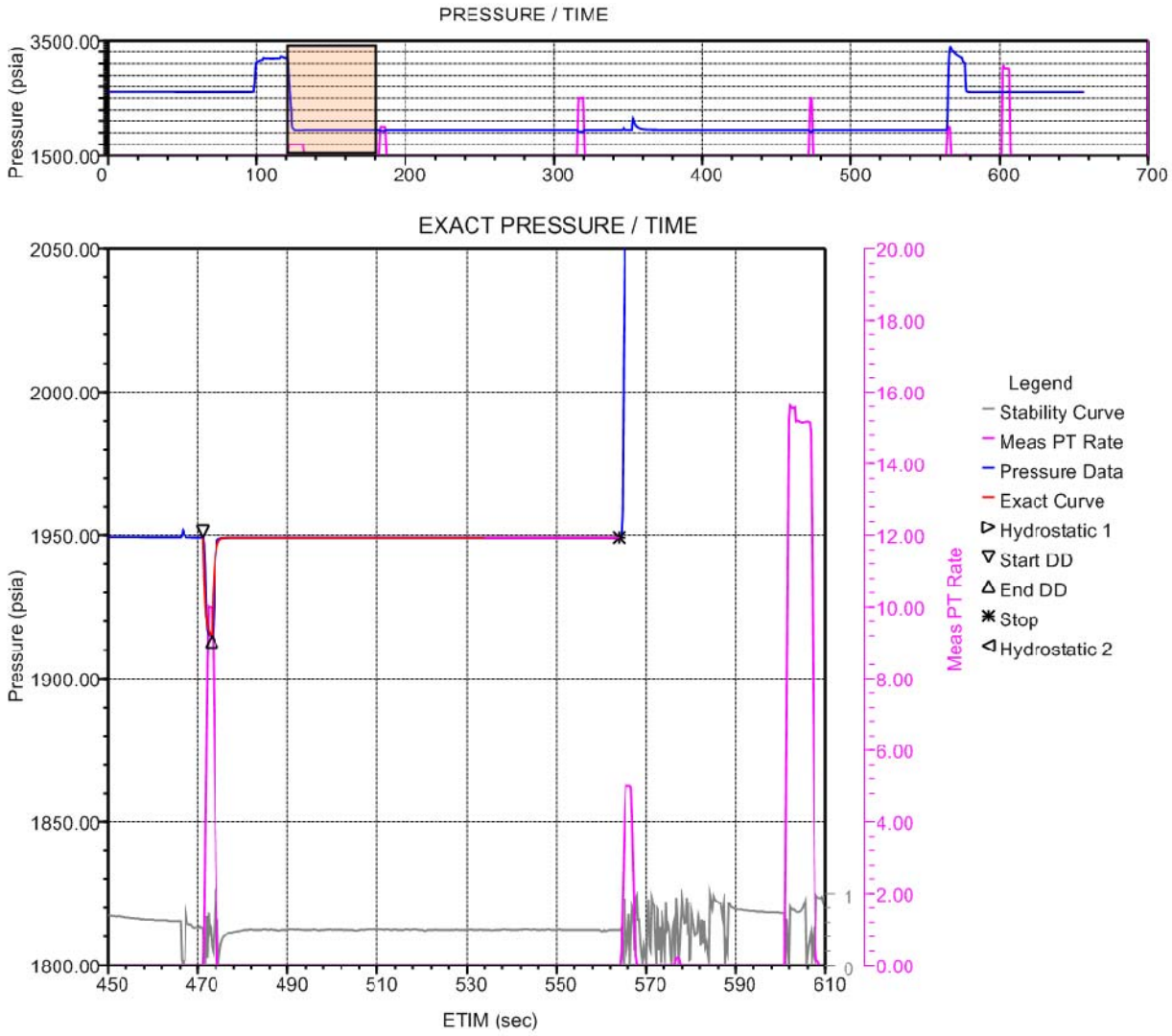
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4788.02	2606.30	2604.60							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
14.46	7.22	0.66	0.25	6.55e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 7.1; MD: 4788.02 ft; TVD: 4788.02 ft

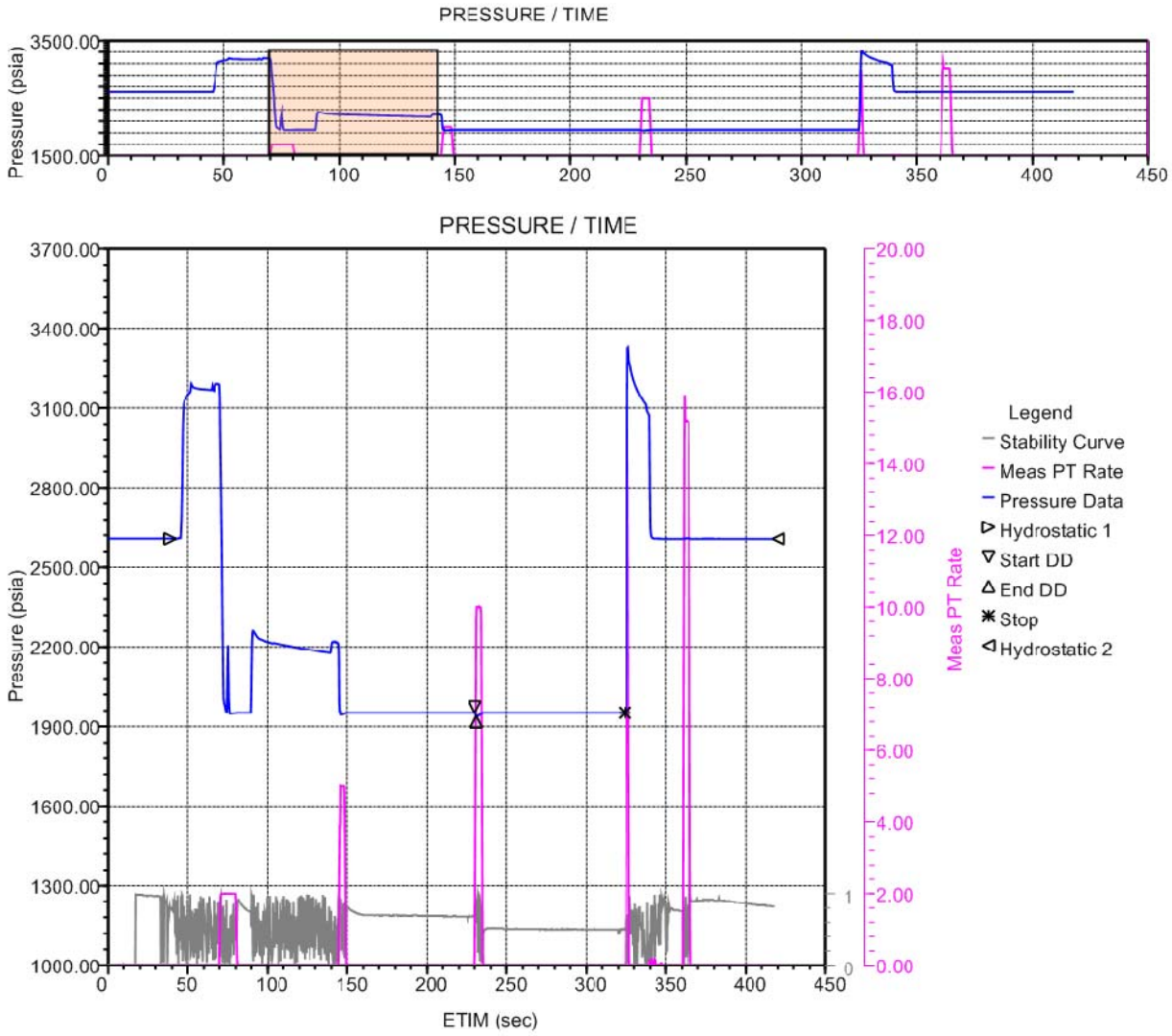
RDT Test File # 5-10.1 Date: 26-Mar-13 01:41:34



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4788.02	4788.02	1914.98	1949.21	1949.21	400
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
14.46	7.22	0.66	0.25	6.55e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.01	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 8.0; MD: 4793.99 ft; TVD: 4793.99 ft

RDT Test File # 5-11.0 Date: 26-Mar-13 01:56:15



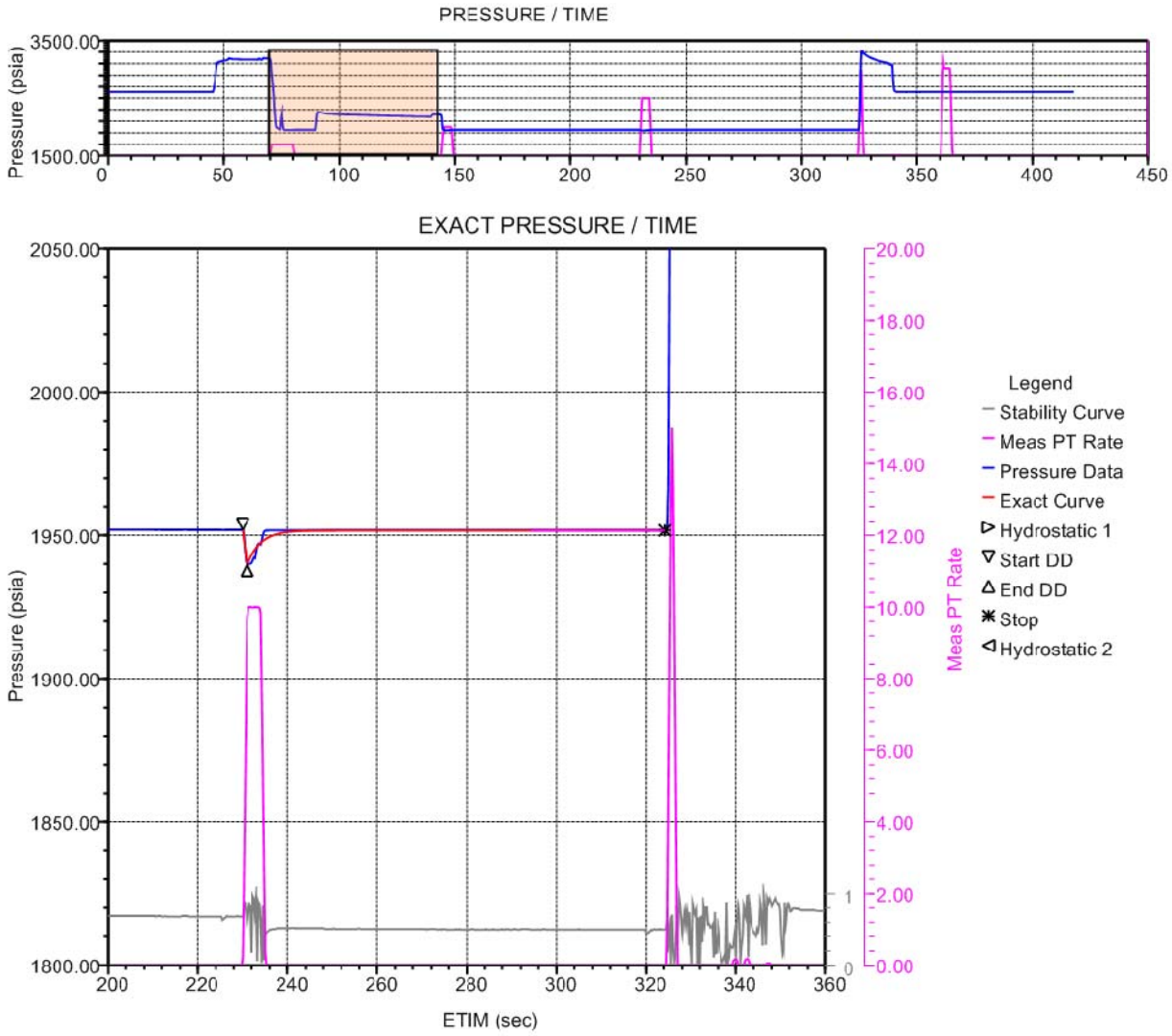
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4793.99	2607.17	2607.07							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
4.91	4.91	0.66	0.25	1.37e-003	180.00

REMARKS
Excellent Buildup Stability

Test No. 8.1; MD: 4793.99 ft; TVD: 4793.99 ft

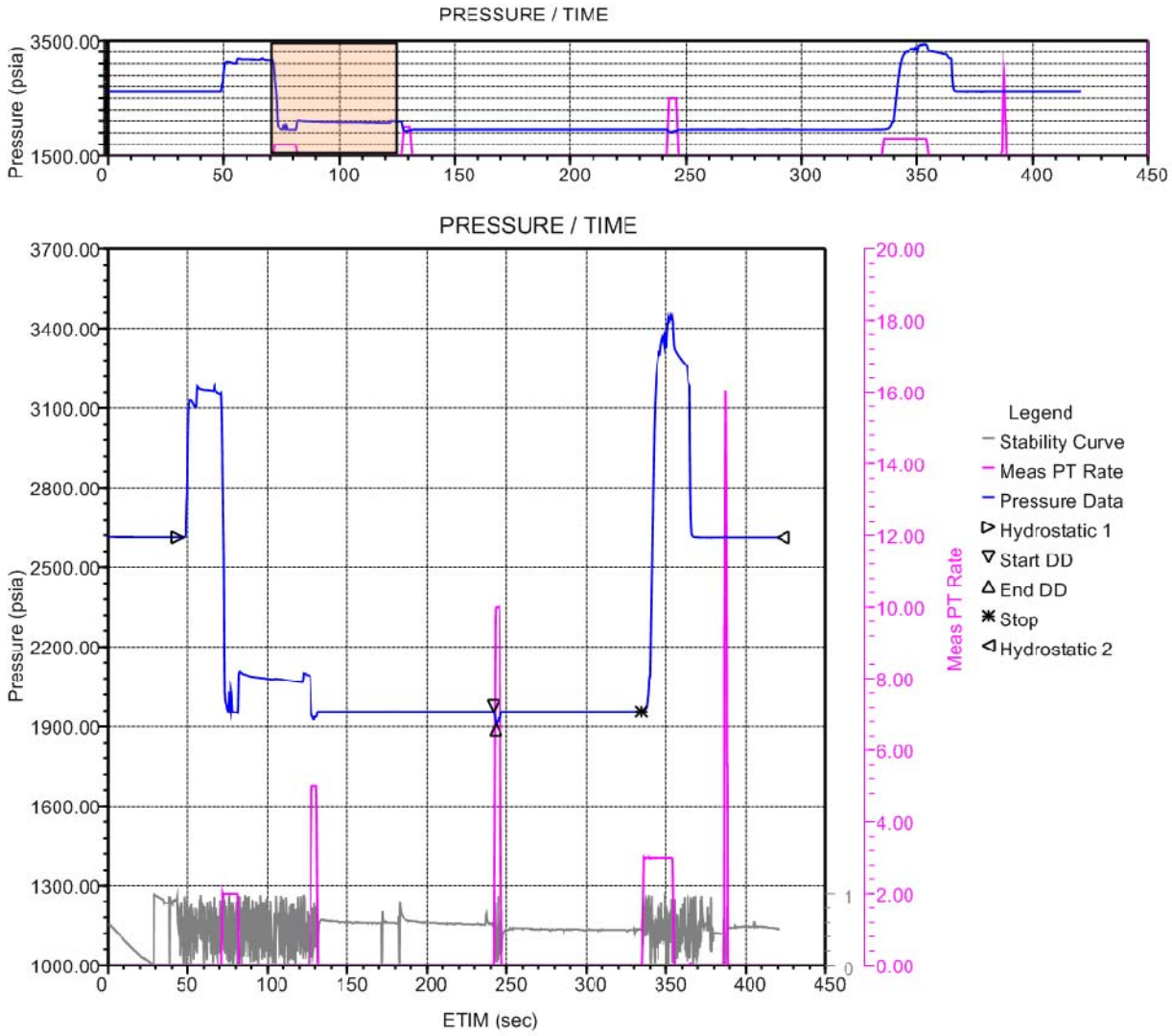
RDT Test File # 5-11.1 Date: 26-Mar-13 01:56:15



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4793.99	4793.99	1939.84	1951.75	1951.75	226
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
4.91	4.91	0.66	0.25	1.37e-003	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.01	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 9.0; MD: 4804.00 ft; TVD: 4804.00 ft

RDT Test File # 5-12.0 Date: 26-Mar-13 02:04:40



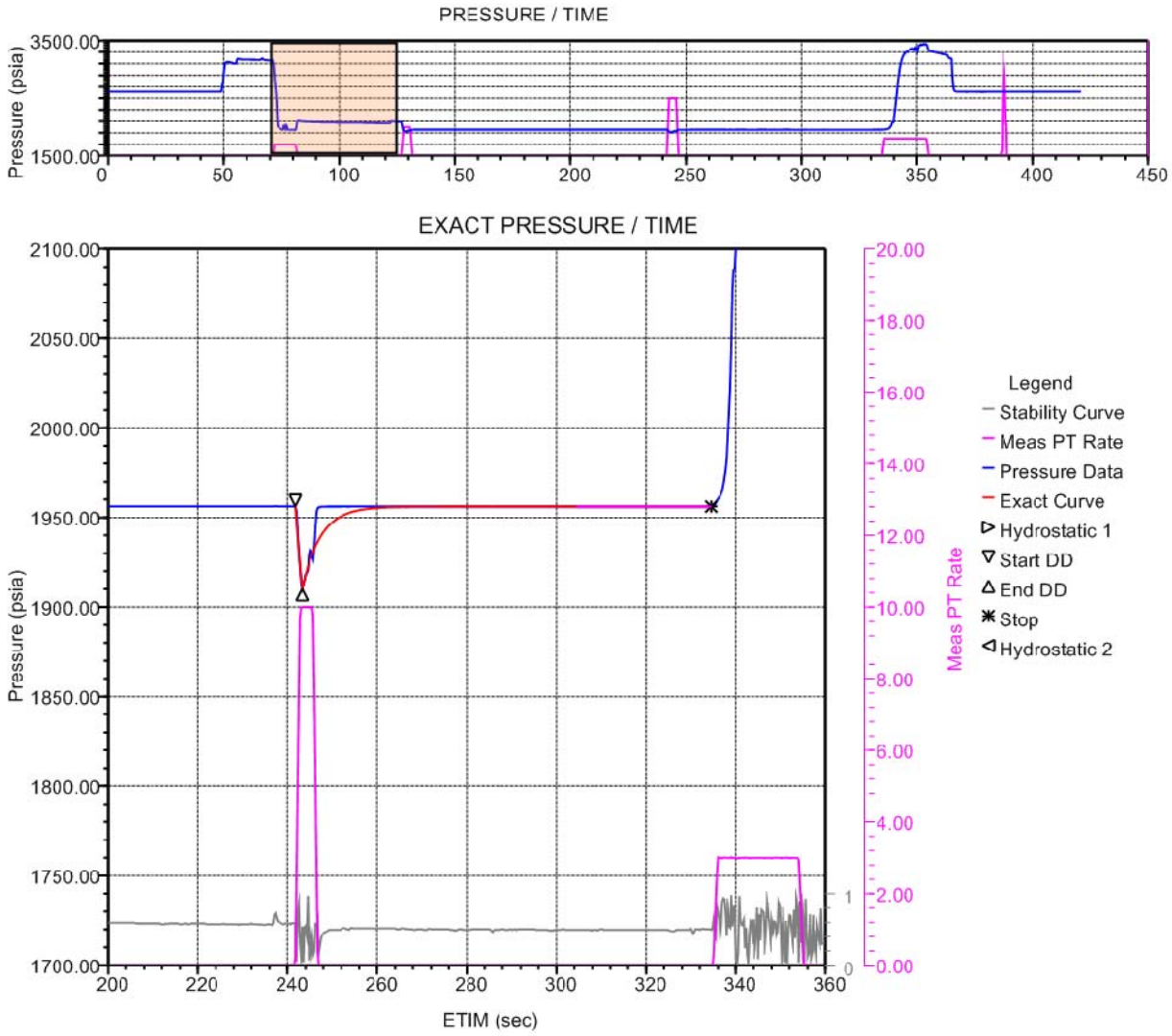
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4804.00	2612.65	2612.16							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
9.56	6.37	0.66	0.25	7.46e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 9.1; MD: 4804.00 ft; TVD: 4804.00 ft

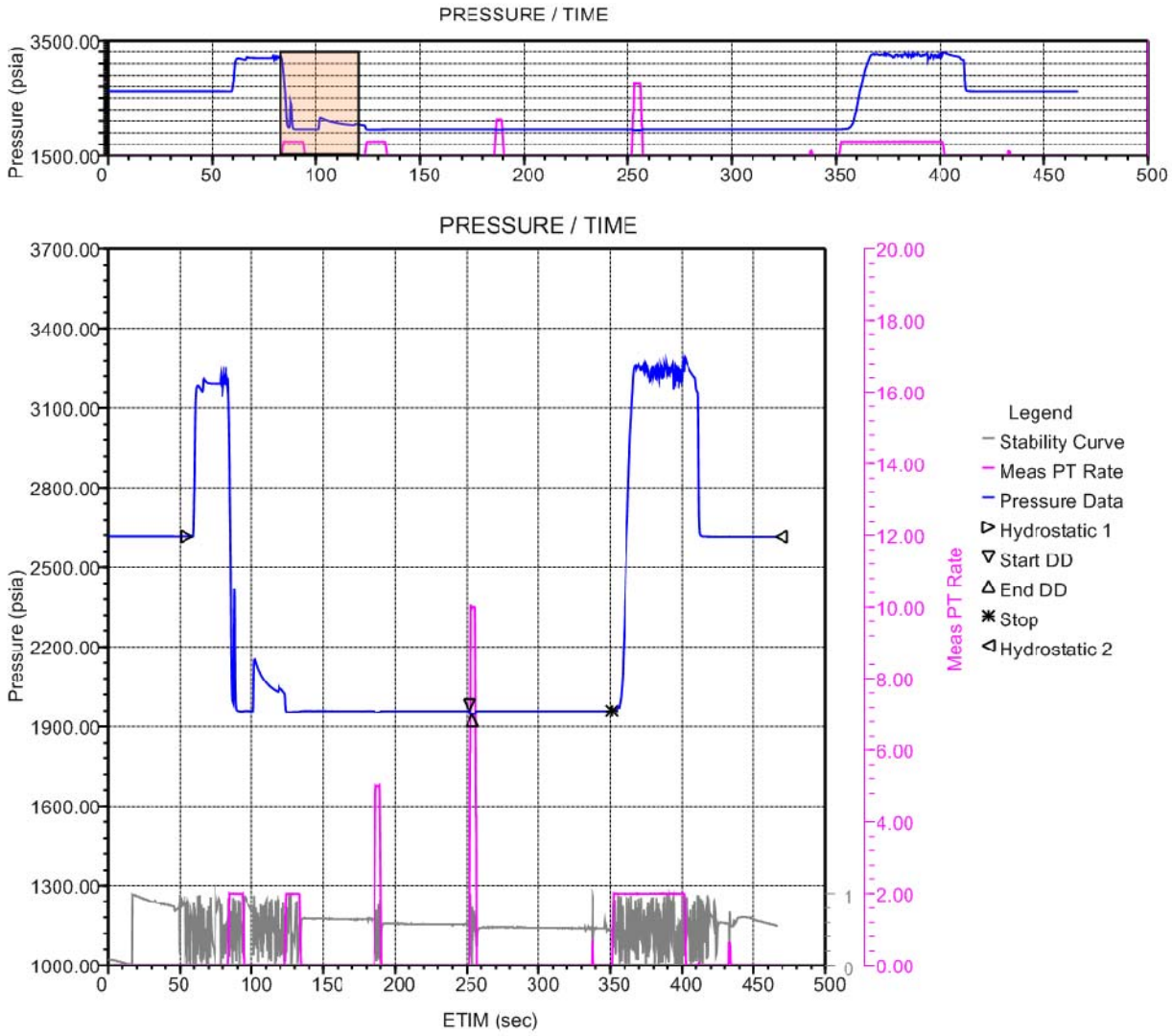
RDT Test File # 5-12.1 Date: 26-Mar-13 02:04:40



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4804.00	4804.00	1910.19	1956.14	1956.14	82.2
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
9.56	6.37	0.66	0.25	7.46e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.09	0.00	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 10.0; MD: 4810.02 ft; TVD: 4810.02 ft

RDT Test File # 5-13.0 Date: 26-Mar-13 02:13:11



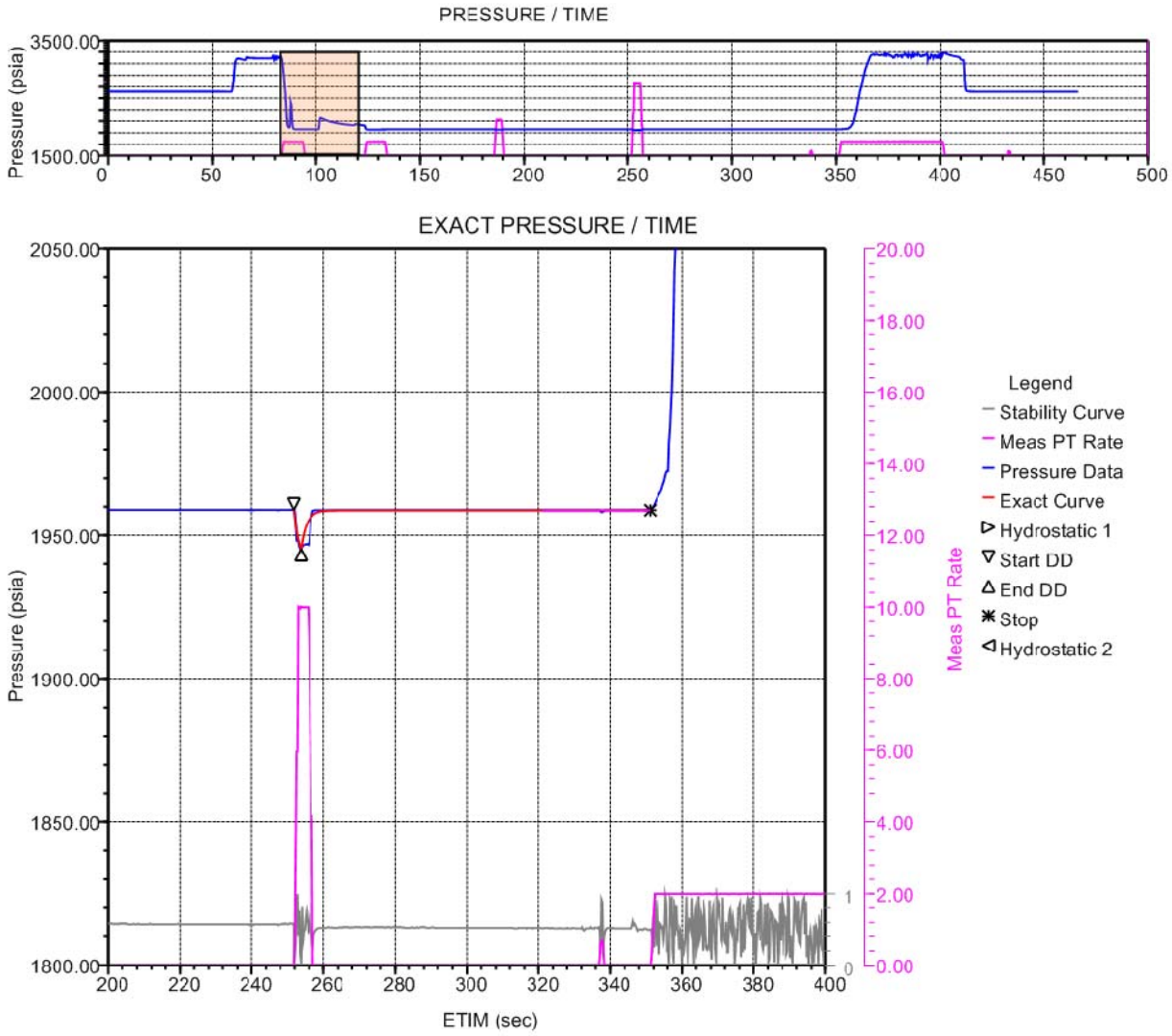
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4810.02	2615.83	2614.84							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
13.83	6.91	0.66	0.25	1.52e-003	180.00

REMARKS
Excellent Buildup Stability

Test No. 10.1; MD: 4810.02 ft; TVD: 4810.02 ft

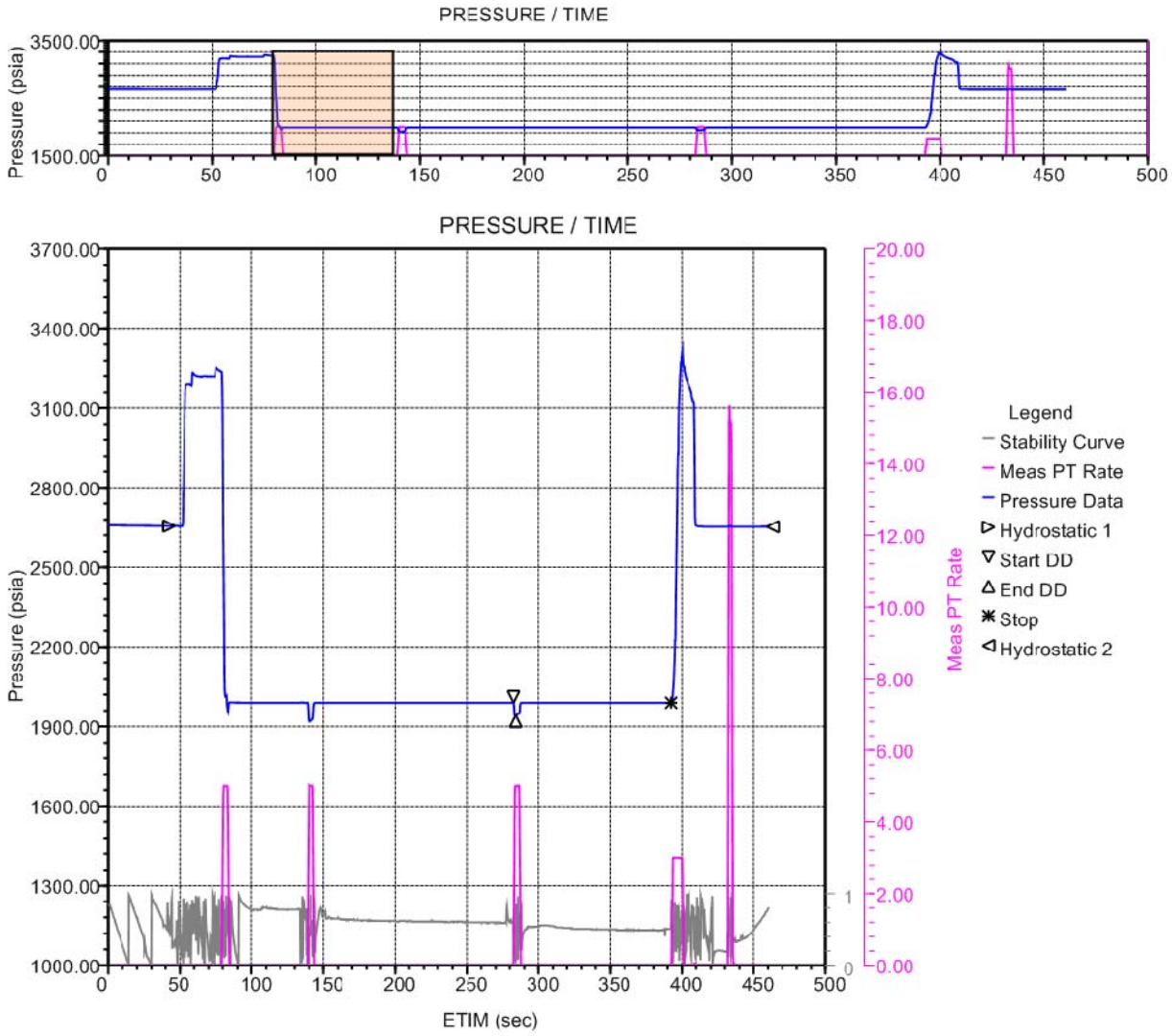
RDT Test File # 5-13.1 Date: 26-Mar-13 02:13:11



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4810.02	4810.02	1945.29	1958.78	1958.78	713
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
13.83	6.91	0.66	0.25	1.52e-003	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.06	-0.02	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 11.0; MD: 4880.01 ft; TVD: 4880.01 ft

RDT Test File # 5-14.0 Date: 26-Mar-13 02:23:17



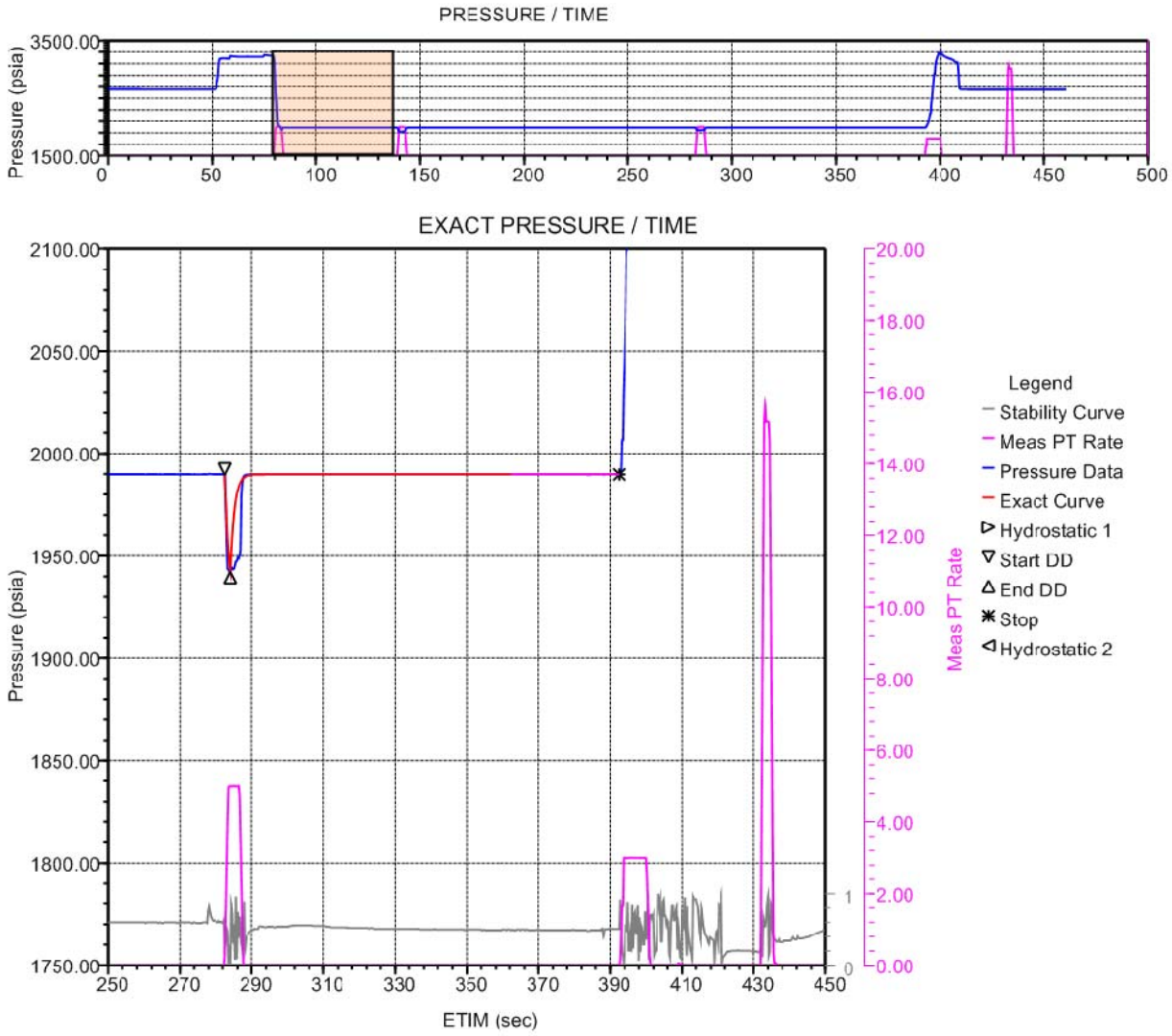
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4880.01	2655.59	2653.02							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
5.01	3.34	0.66	0.25	2.23e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 11.1; MD: 4880.01 ft; TVD: 4880.01 ft

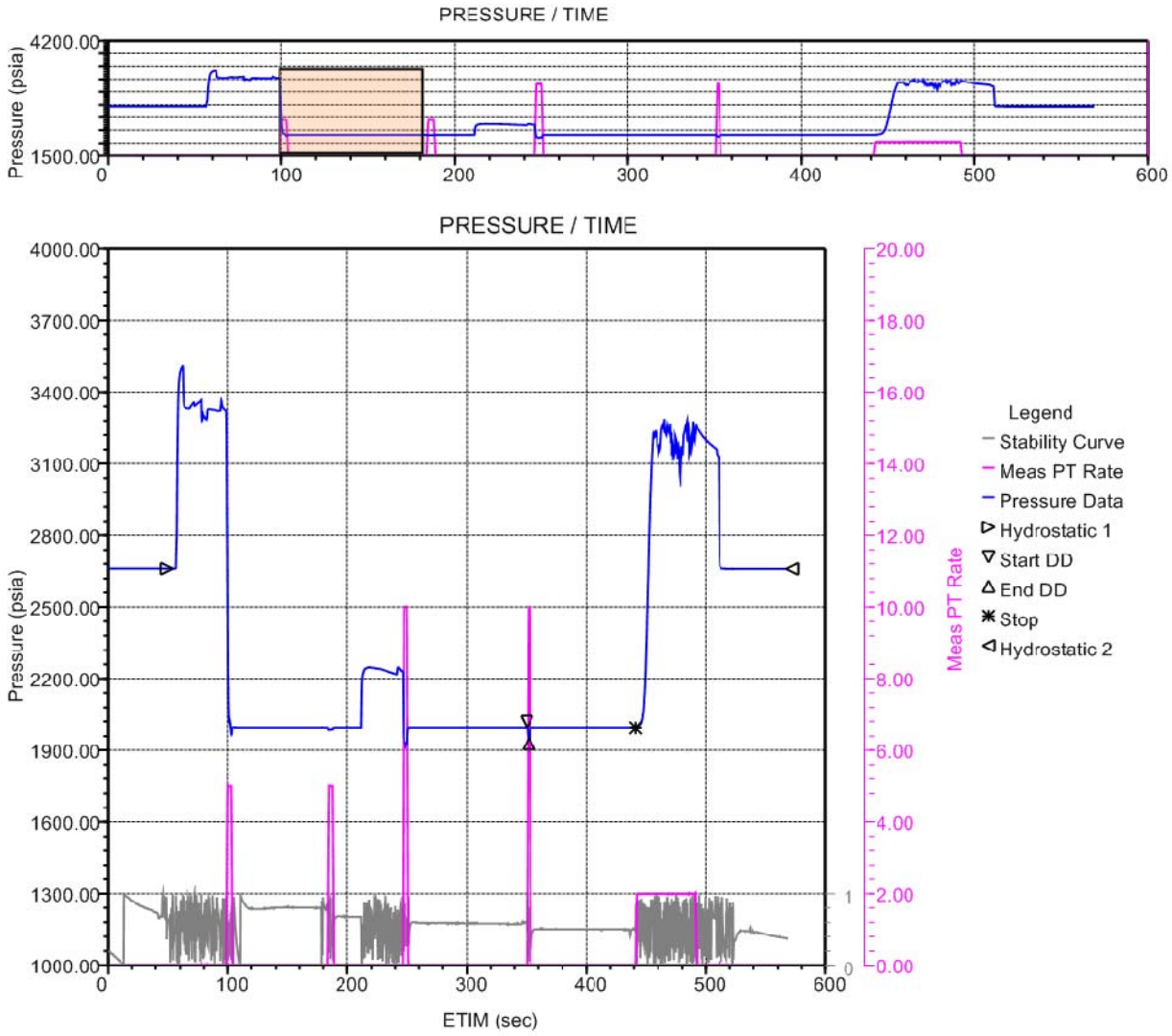
RDT Test File # 5-14.1 Date: 26-Mar-13 02:23:17



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4880.01	4880.01	1942.30	1989.77	1989.77	101
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
5.01	3.34	0.66	0.25	2.23e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.02	0.01	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 12.0; MD: 4890.02 ft; TVD: 4890.02 ft

RDT Test File # 5-15.0 Date: 26-Mar-13 02:32:40



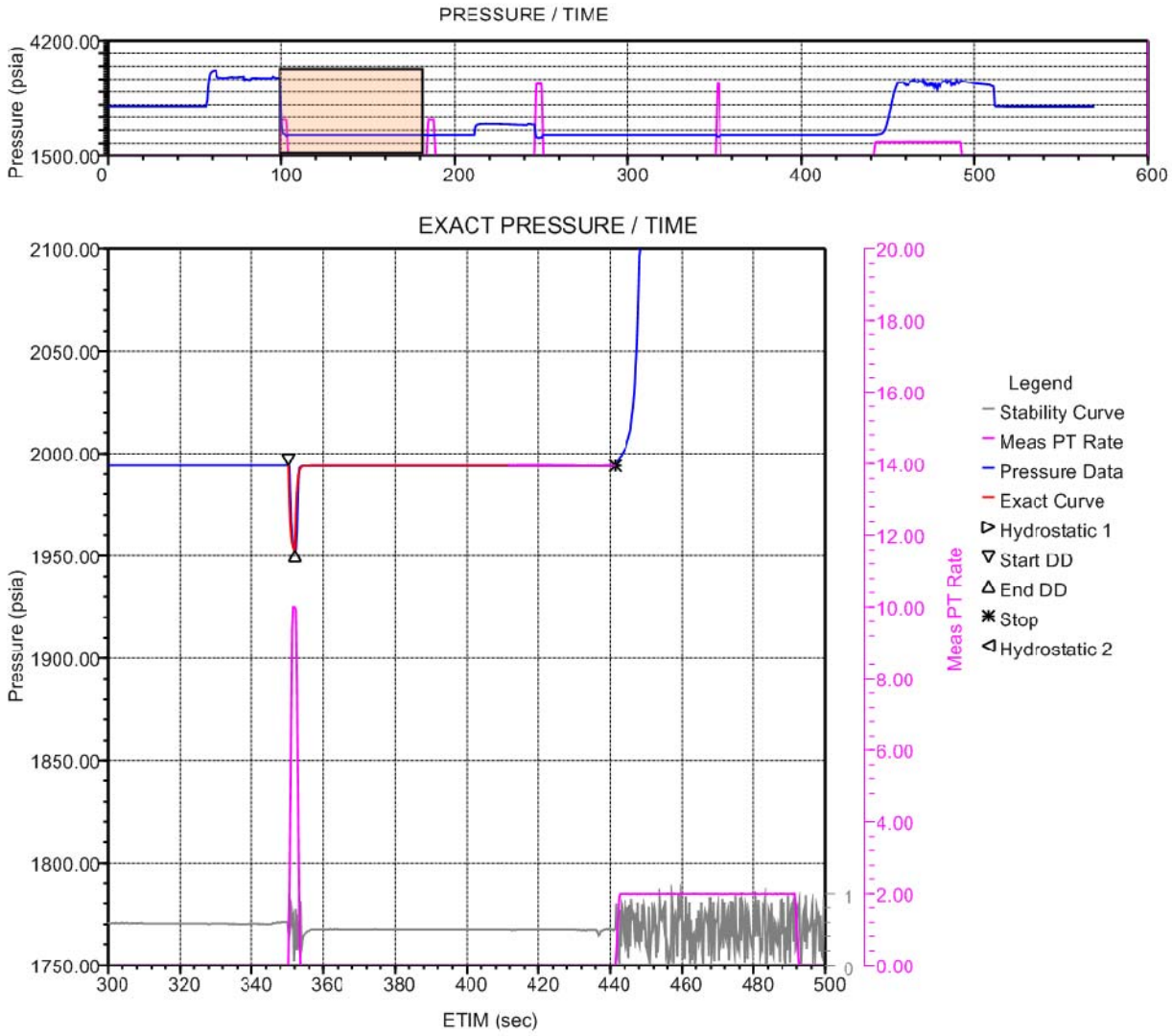
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4890.02	2660.62	2659.93							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
12.72	7.26	0.66	0.25	6.99e-004	180.00

REMARKS
Excellent Buildup Stability

Test No. 12.1; MD: 4890.02 ft; TVD: 4890.02 ft

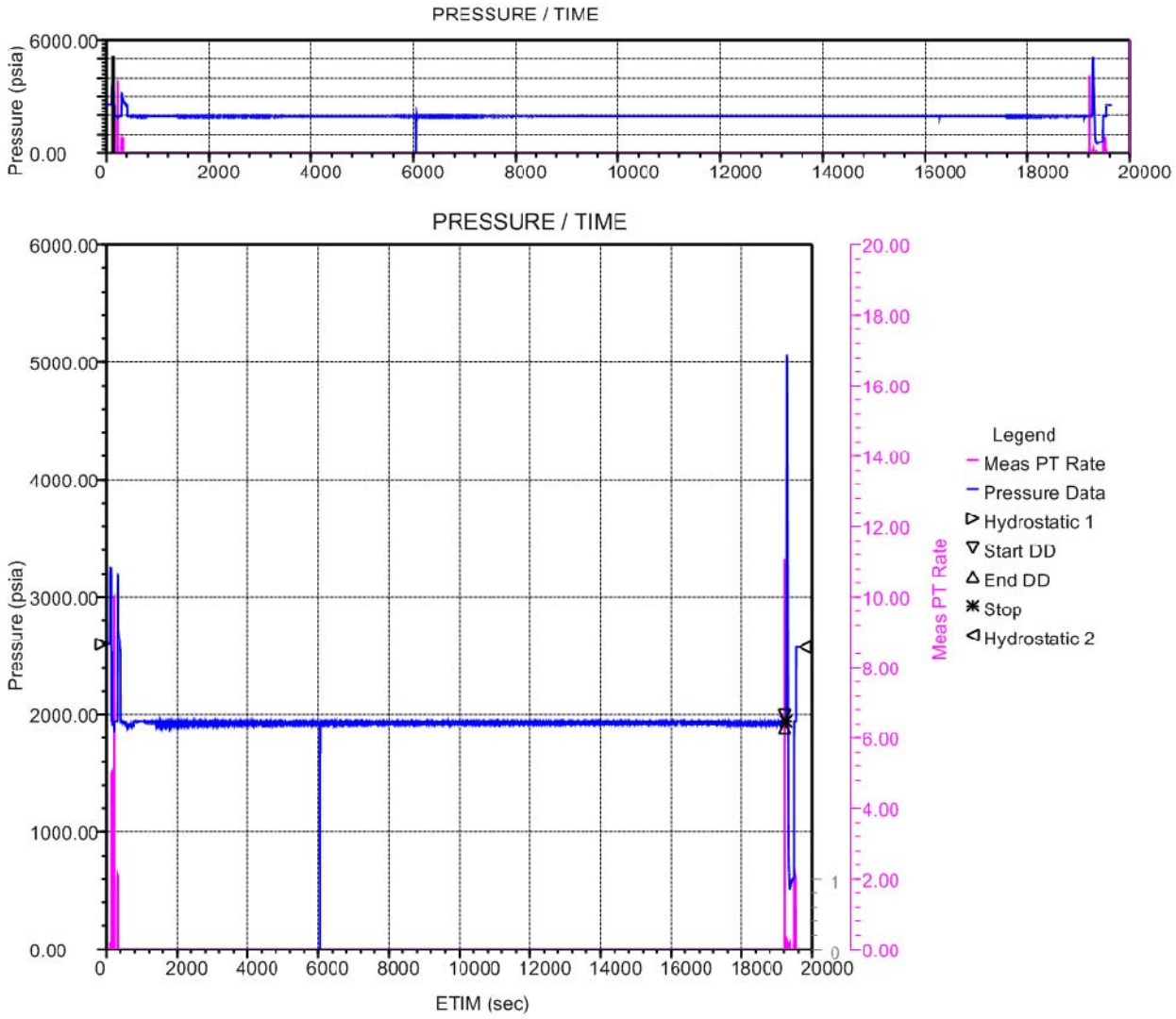
RDT Test File # 5-15.1 Date: 26-Mar-13 02:32:40



EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4890.02	4890.02	1952.88	1994.05	1994.05	333
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
12.72	7.26	0.66	0.25	6.99e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.02	0.00			
REMARKS					
Excellent Buildup Stability					

Test No. 13.0; MD: 4774.00 ft; TVD: 4774.00 ft

RDT Test File # 5-16.0 Date: 26-Mar-13 02:47:46



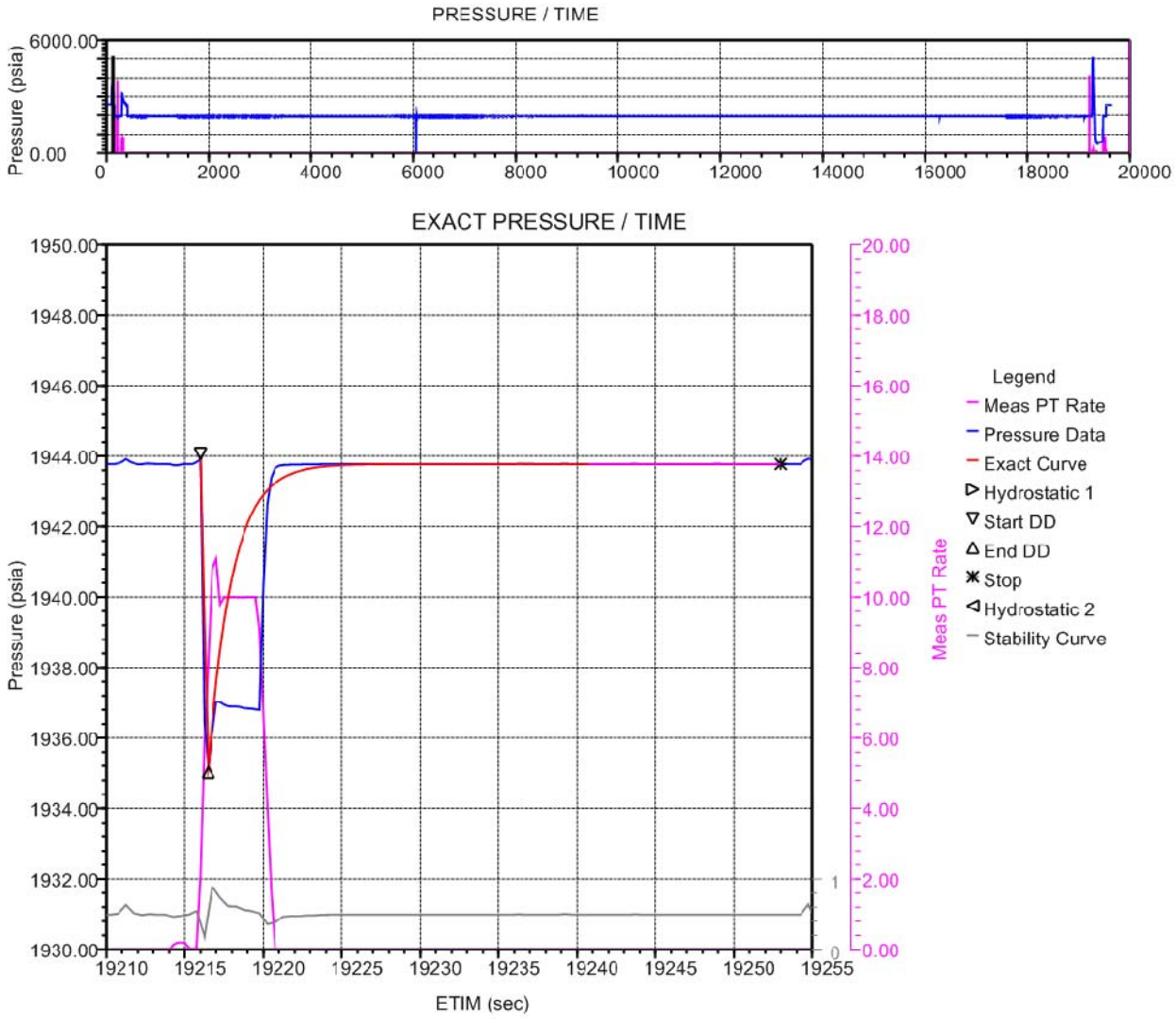
PRESSURE/TIME PLOT SUMMARY									
Depth	**Hydrostatic**		**Pretest Pressures**			**Pretest Times**			**Mobility**
MD (ft)	**Phyds1 (psia)**	**Phyds2 (psia)**	**Psdd (psia)**	**Pedd (psia)**	**Pstop (psia)**	**Tsdd (sec)**	**Tedd (sec)**	**Tstop (sec)**	**Mdd (md/cp)**
4774.00	2599.36	2574.01							

CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
2.60	5.20	0.66	0.25	9.70e-004	180.00

REMARKS
Excellent Buildup Stability

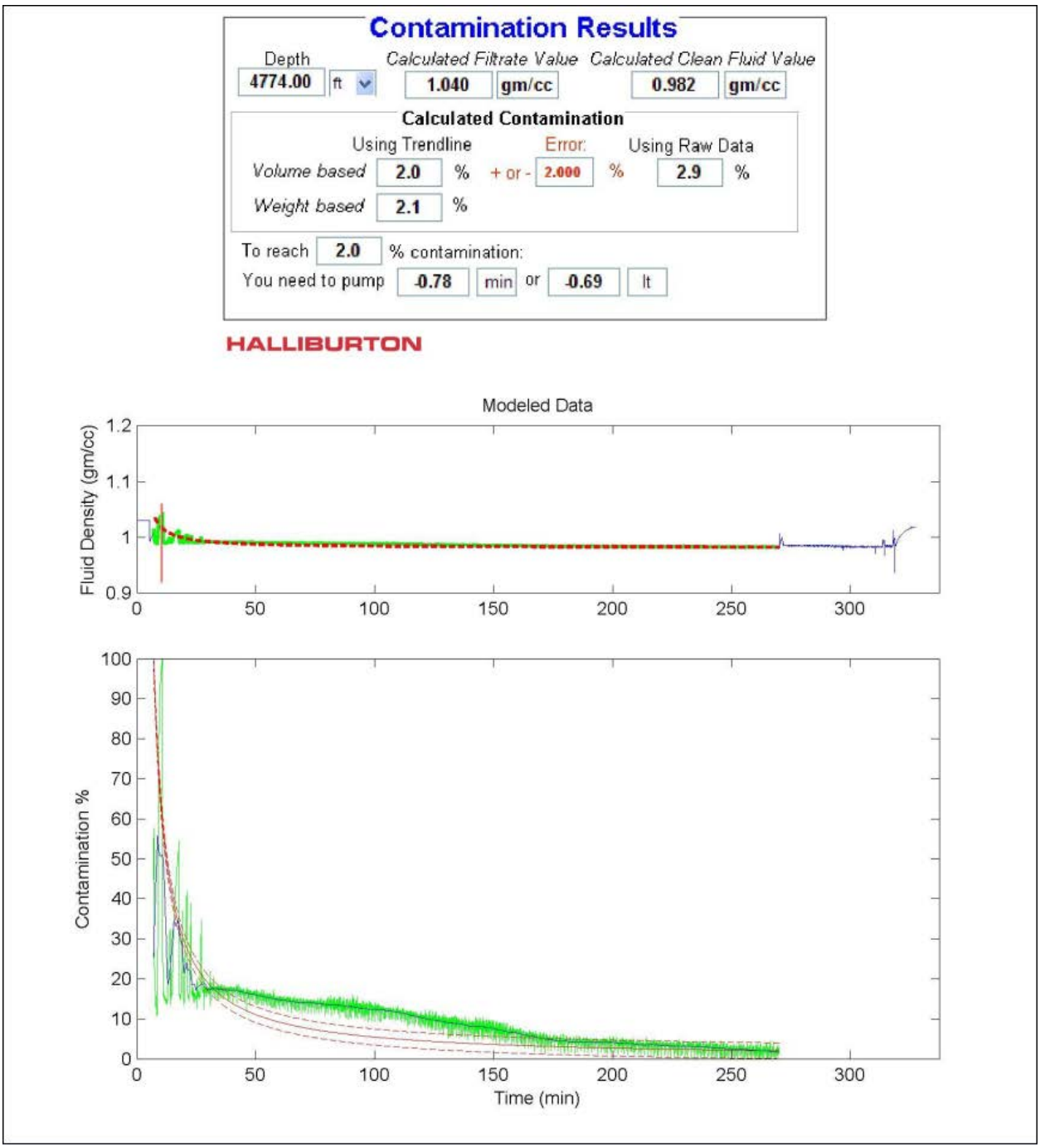
Test No. 13.1; MD: 4774.00 ft; TVD: 4774.00 ft

RDT Test File # 5-16.1 Date: 26-Mar-13 02:47:46

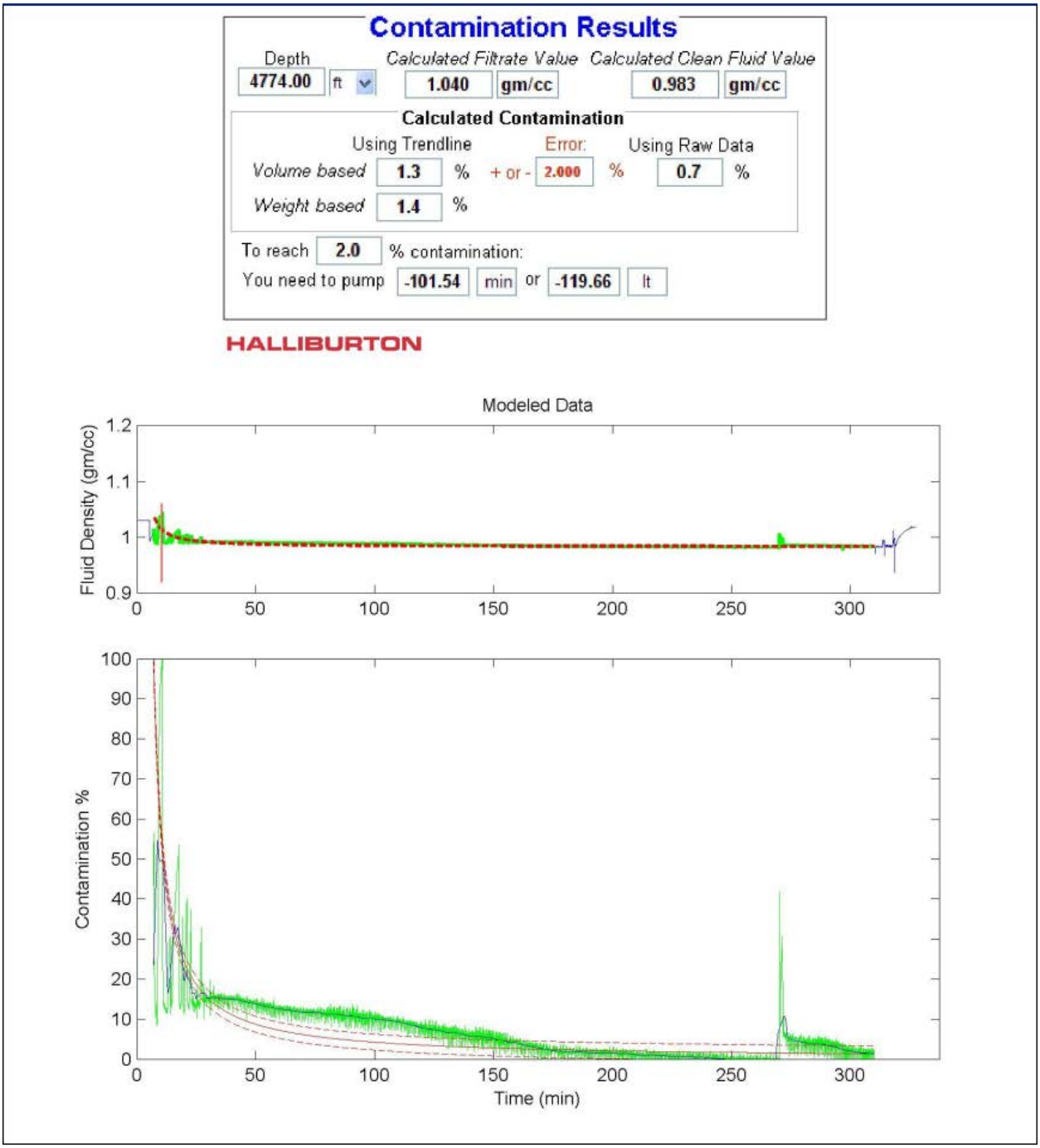


EXACT PRESSURE / TIME PLOT SUMMARY					
MD (ft)	**TVD (ft)**	**Pedd (psia)**	**Pstop (psia)**	**Pexact (psia)**	**Mexact(md/cp)**
4774.00	4774.00	1935.19	1943.78	1943.78	323
CONSTANTS - SPHERICAL FLOW					
Volume (cc)	**Rate (cc/sec).**	**Rsnorkel (in)**	**Porosity (fraction)**	**Ct (1/psia)**	**Flow-line Storage (cc)**
2.60	5.20	0.66	0.25	9.70e-004	180.00
TEST CONDITIONS & STATUS					
+/- stdev (psia)	**Stability (psi/min).**	**Stability (deg/min).**	**Pump Status**	**Exposure Time (hr).**	**Tool Face (deg).**
0.01	-0.00	0.00			
REMARKS					
Excellent Buildup Stability					

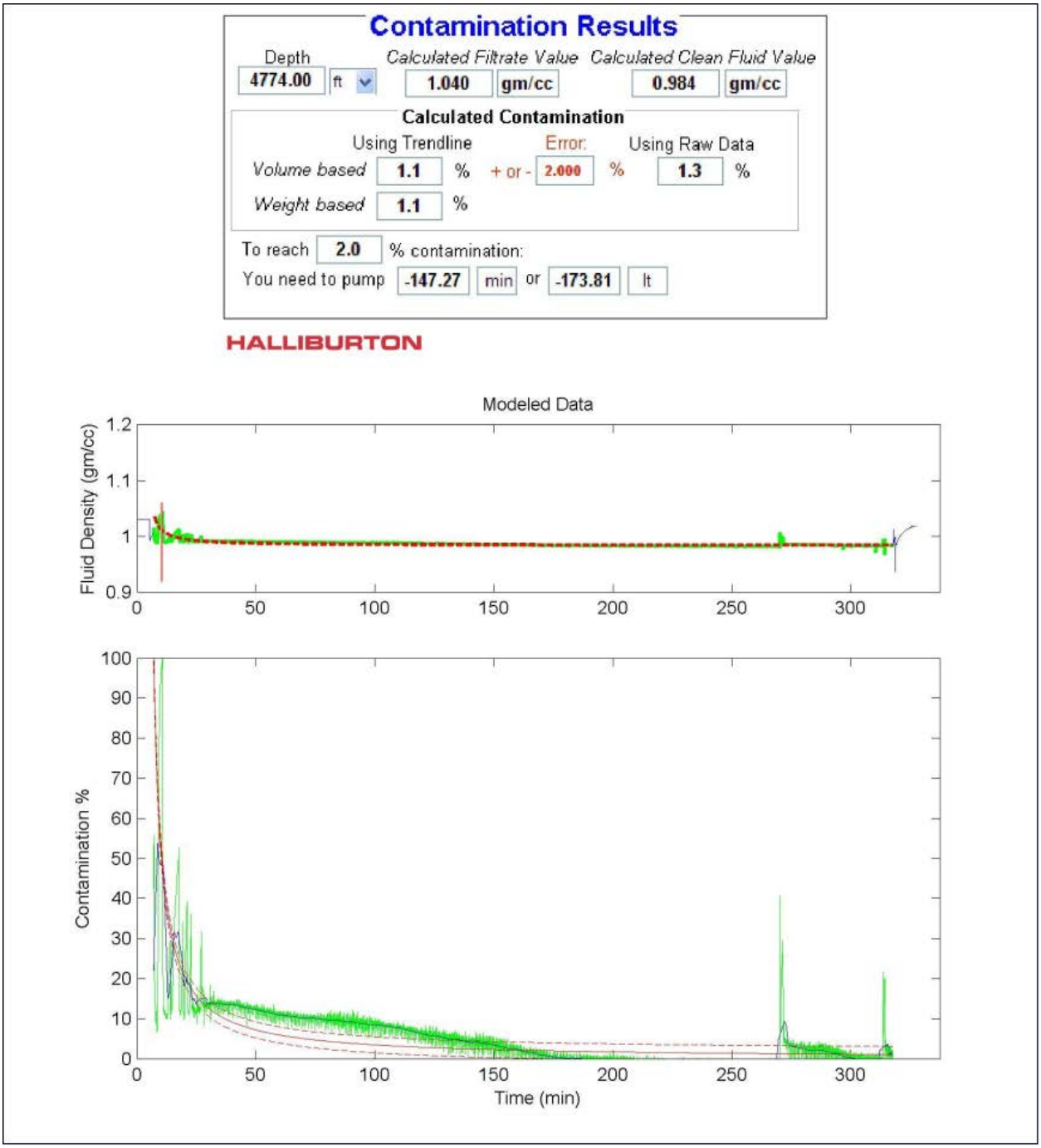
SAMPLE 1


Contamination Results
Depth
4774.00
ft
Calculated Filtrate Value
1.040
gm/cc
Calculated Clean Fluid Value
0.982
gm/cc
Calculated Contamination
Using Trendline
Error:
Using Raw Data
Volume based
2.0
%
+ or -
2.000
%
2.9
%
Weight based
2.1
%
To reach
2.0
% contamination:
You need to pump
-0.78
min
or
-0.69
lt
HALLIBURTON
Modeled Data
Fluid Density (gm/cc)
Contamination %
Time (min)

SAMPLE 2


Contamination Results
Depth
4774.00
ft
Calculated Filtrate Value
1.040
gm/cc
Calculated Clean Fluid Value
0.983
gm/cc
Calculated Contamination
Using Trendline
Error:
Using Raw Data
Volume based
1.3
%
+ or -
2.000
%
0.7
%
Weight based
1.4
%
To reach
2.0
% contamination:
You need to pump
-101.54
min
or
-119.66
lt
HALLIBURTON
Modeled Data
Fluid Density (gm/cc)
1.2
1.1
1
0.9
0
50
100
150
200
250
300
Contamination %
100
90
80
70
60
50
40
30
20
10
0
Time (min)

SAMPLE 3


Contamination Results
Depth
4774.00
ft
Calculated Filtrate Value
1.040
gm/cc
Calculated Clean Fluid Value
0.984
gm/cc
Calculated Contamination
Using Trendline
Error:
Using Raw Data
Volume based
1.1
%
+ or -
2.000
%
1.3
%
Weight based
1.1
%
To reach
2.0
% contamination:
You need to pump
-147.27
min
or
-173.81
lt
HALLIBURTON
Modeled Data
Fluid Density (gm/cc)
1.2
1.1
1
0.9
0
50
100
150
200
250
300
Contamination %
100
90
80
70
60
50
40
30
20
10
0
Time (min)

Disclaimer

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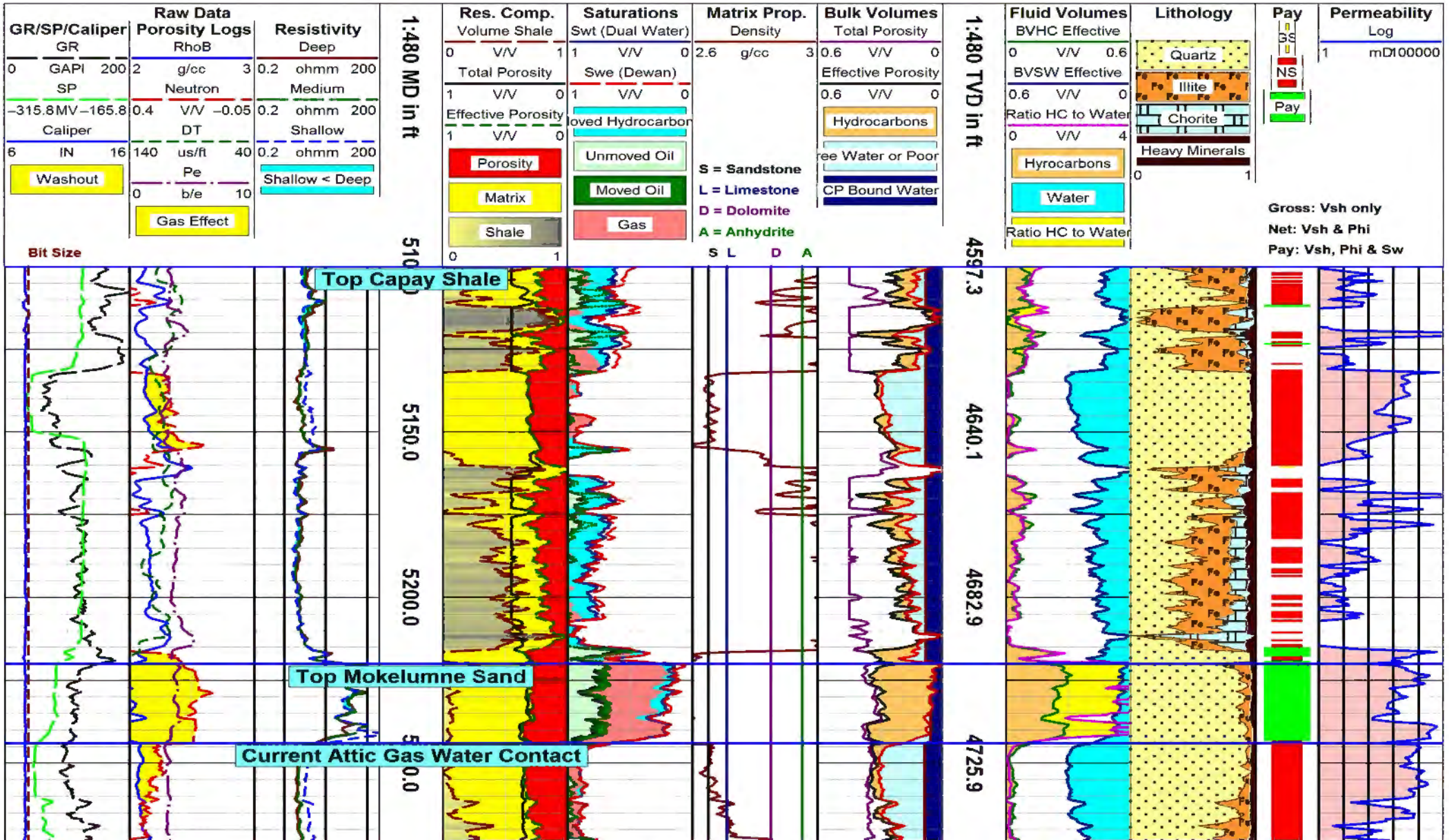
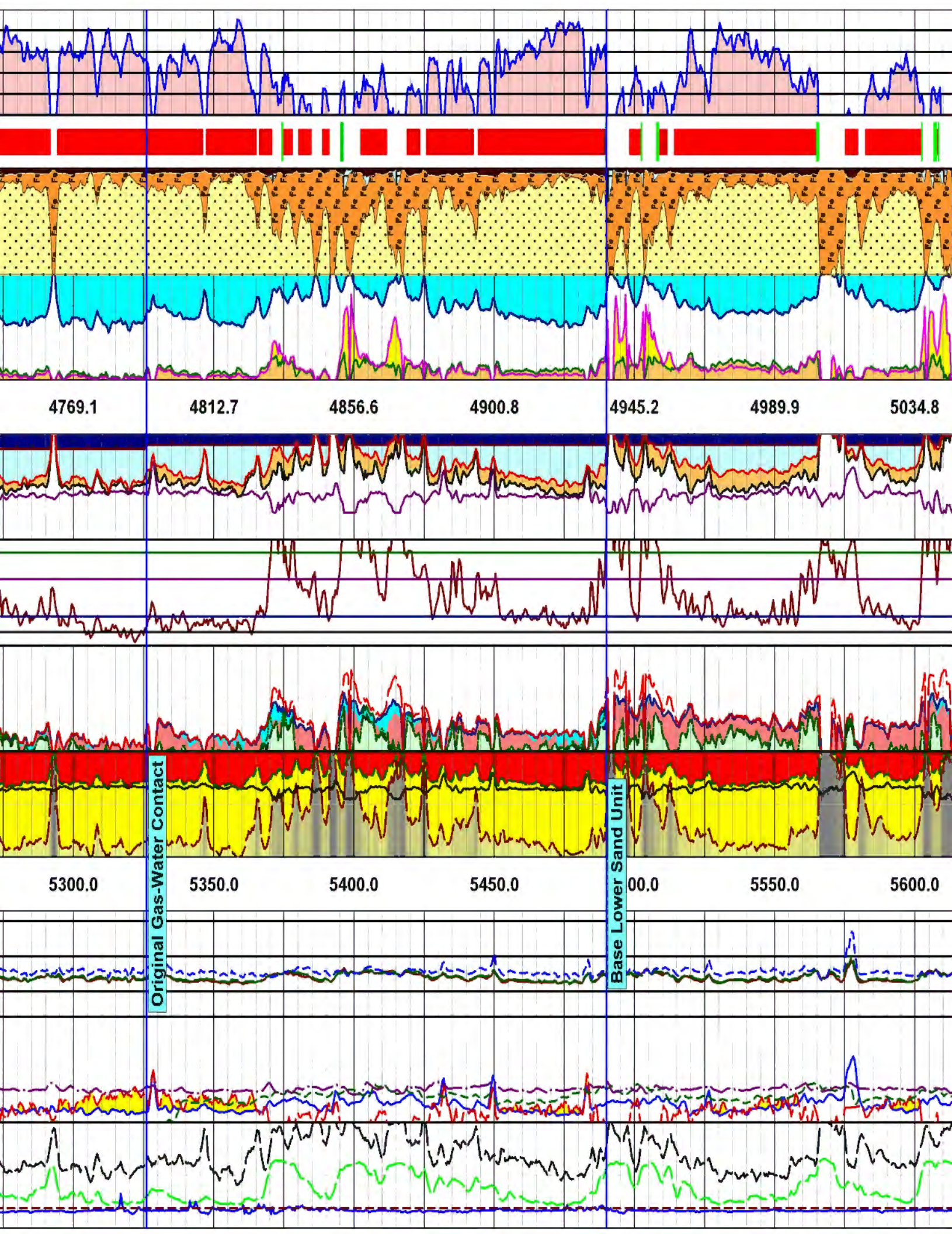
File: Citizen Green 1.lbs Well Name: Citizen_Green_1
Plot: L-Full Composite Log - Clean Formation with Lithology-High Porosity
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: Zones: Top Capay Shale, Top Mokelumne Sand, Current Attic Gas Water Contact, ...
5100-5220, 5220-5244, 5244-5326, 5326-5490, 5490-7550

Time:	11:42 AM		Date:	Mon, Dec 09, 2013			
Section:	28		Township:	3N		API #:	07720688
Location:			Range:	5E		UWI:	Citizen_Green_1
Logging date:	20-Dec-2011						
GL:	-6	ft	Rm:	3.24	ohmm	Rm Temp:	73.1 degF
KB:	12	ft	Rmf:	2.57	ohmm	Rmf Temp:	73.1 degF
Total Depth:	7570	ft	Rm @ BHT:	1.61	ohmm	Max Temp:	154 degF

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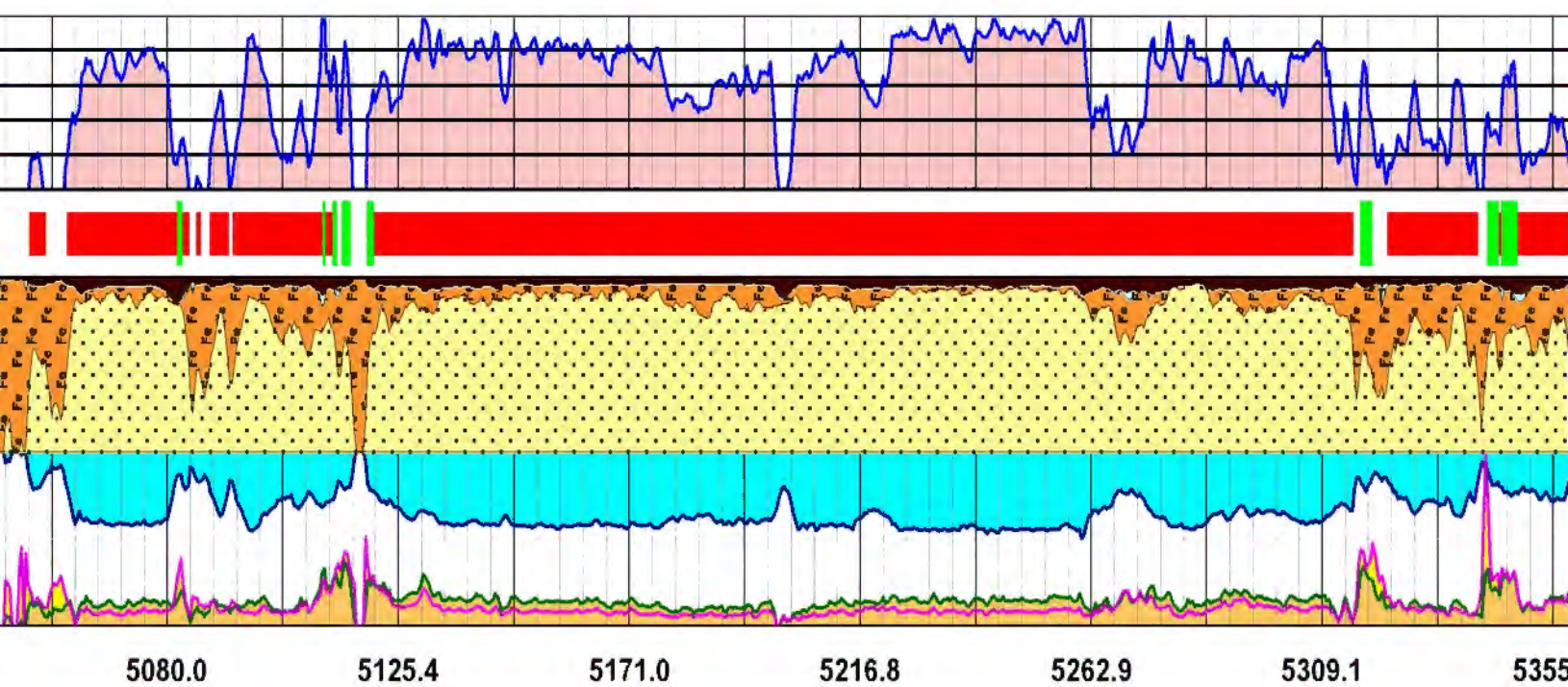
4812.7
4856.6
4900.8
4945.2
4989.9
5034.8
5300.0
5350.0
5400.0
5450.0
00.0
5550.0
5600.0
Original Gas-Water Contact
Base Lower Sand Unit



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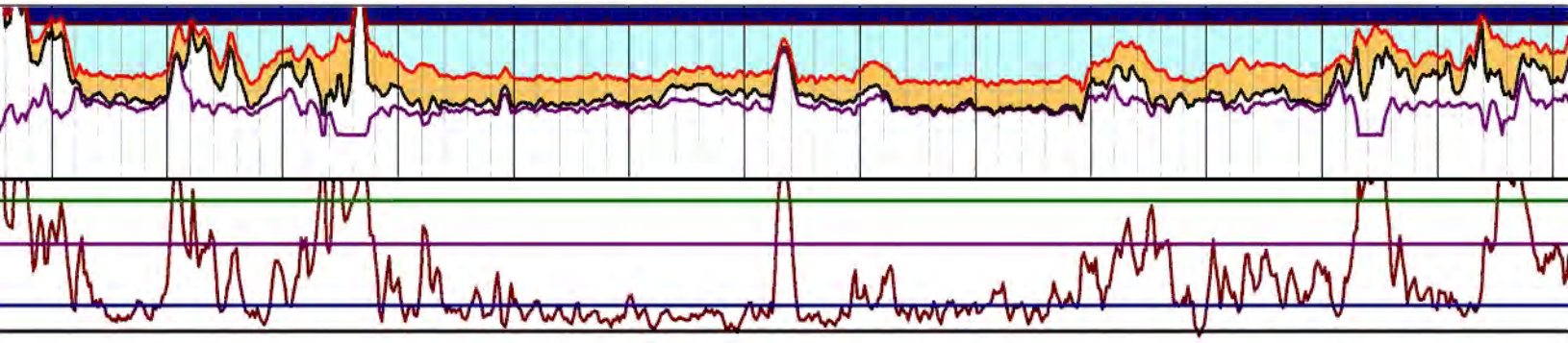

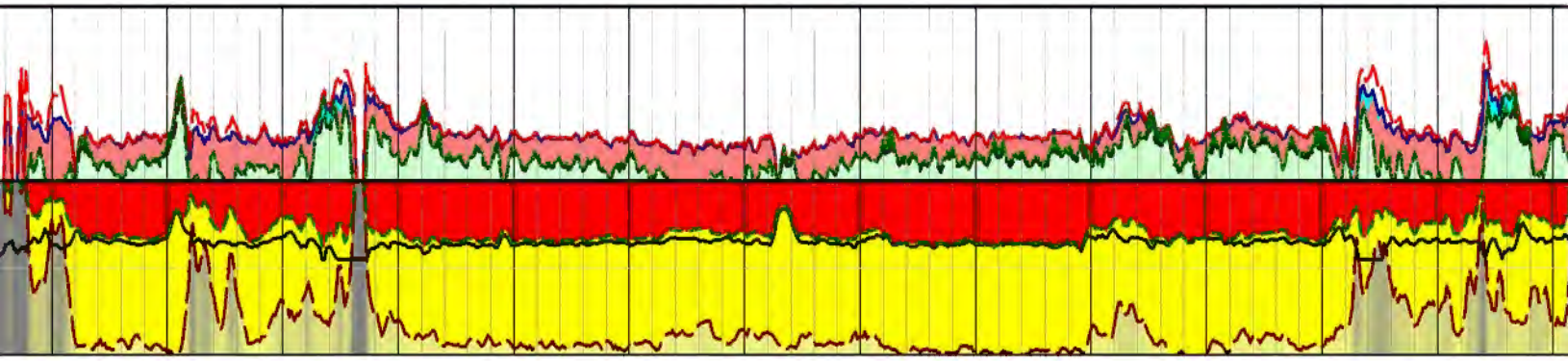

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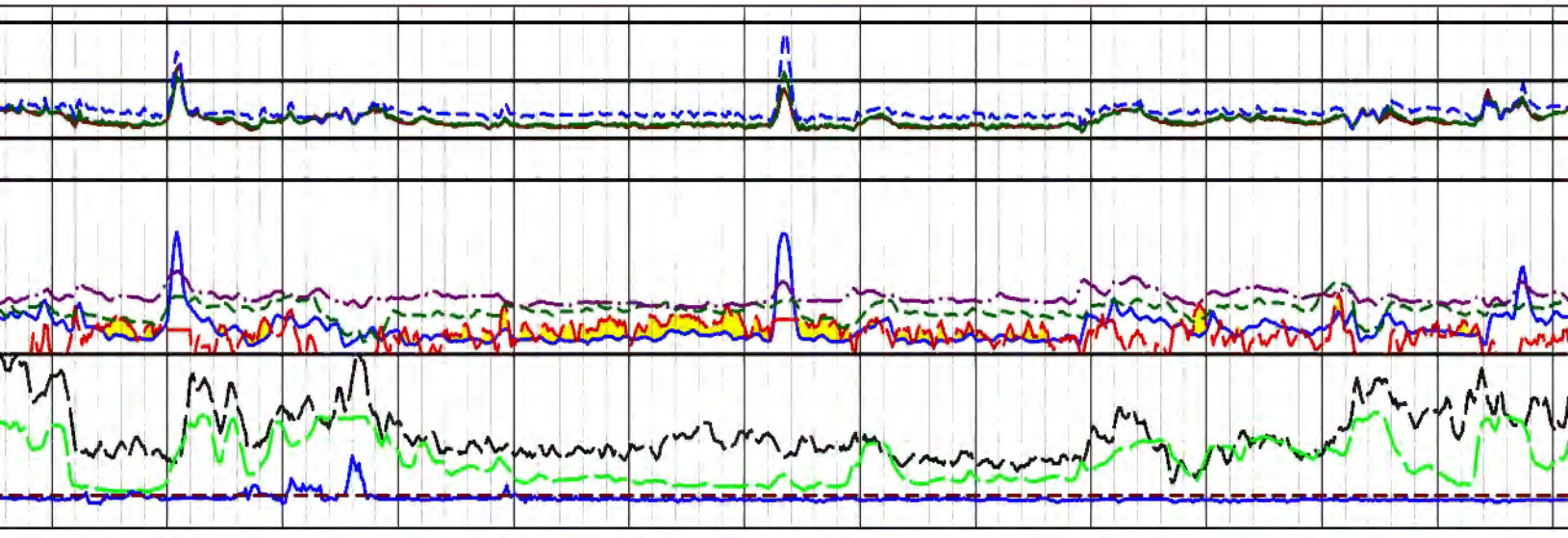

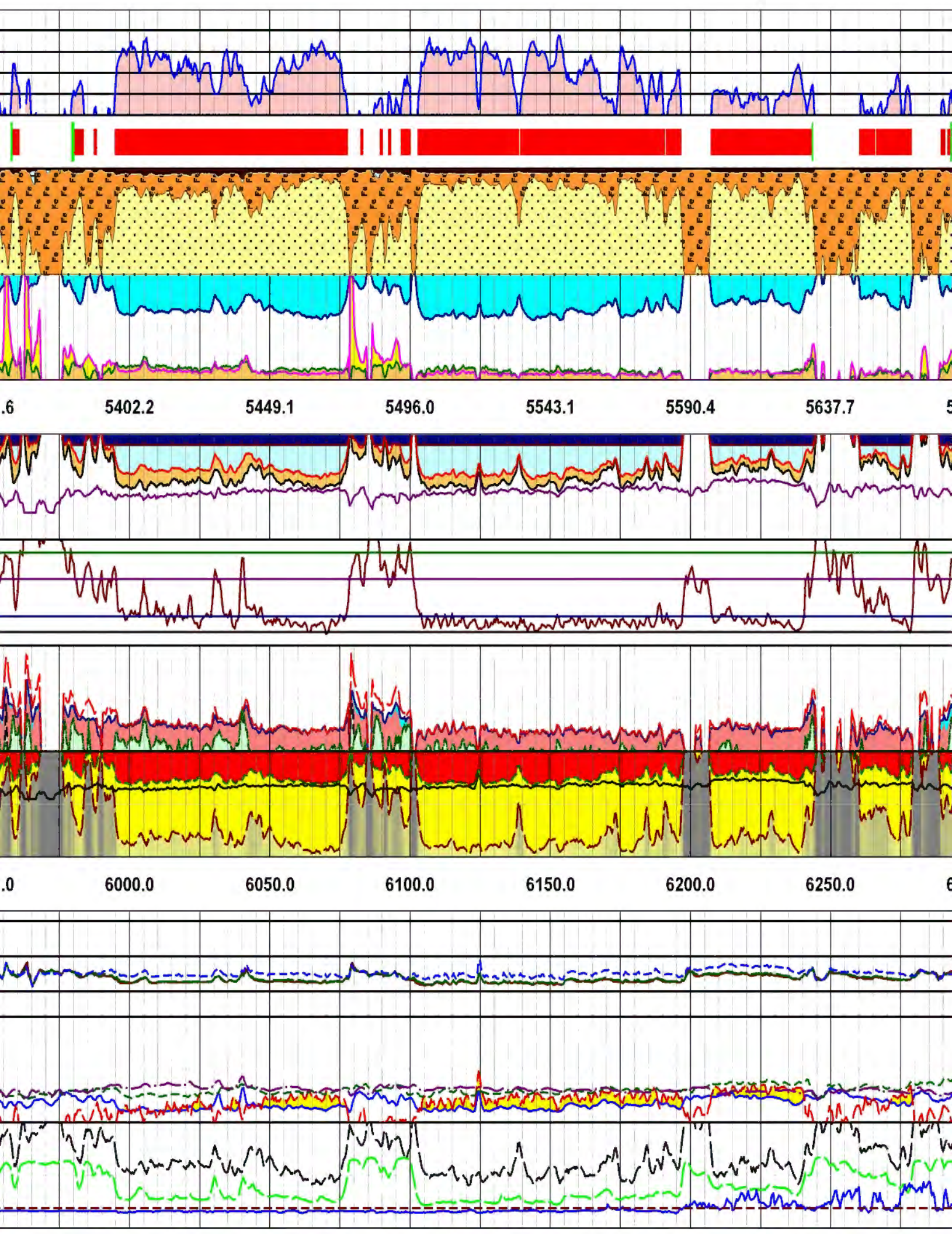
.6
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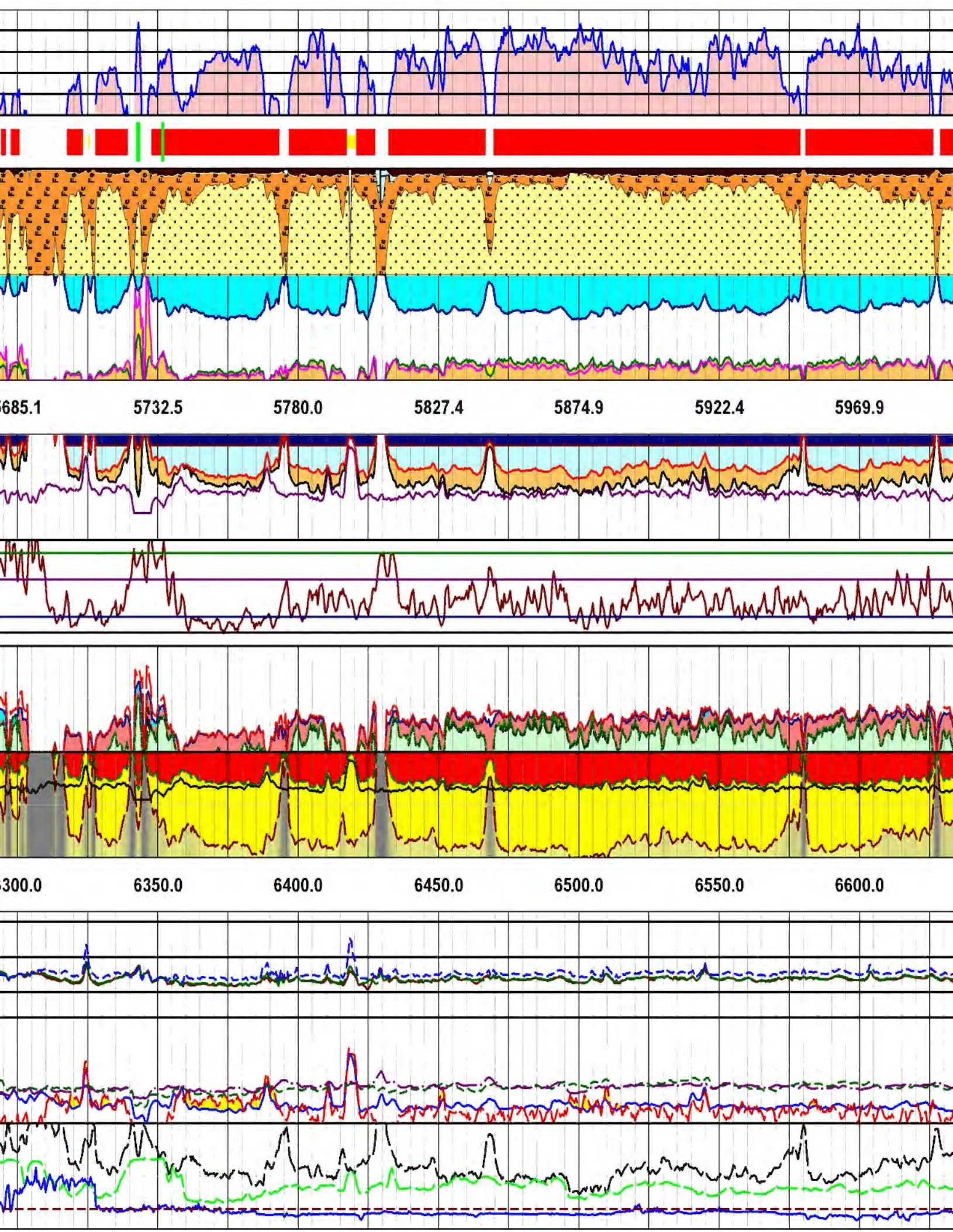
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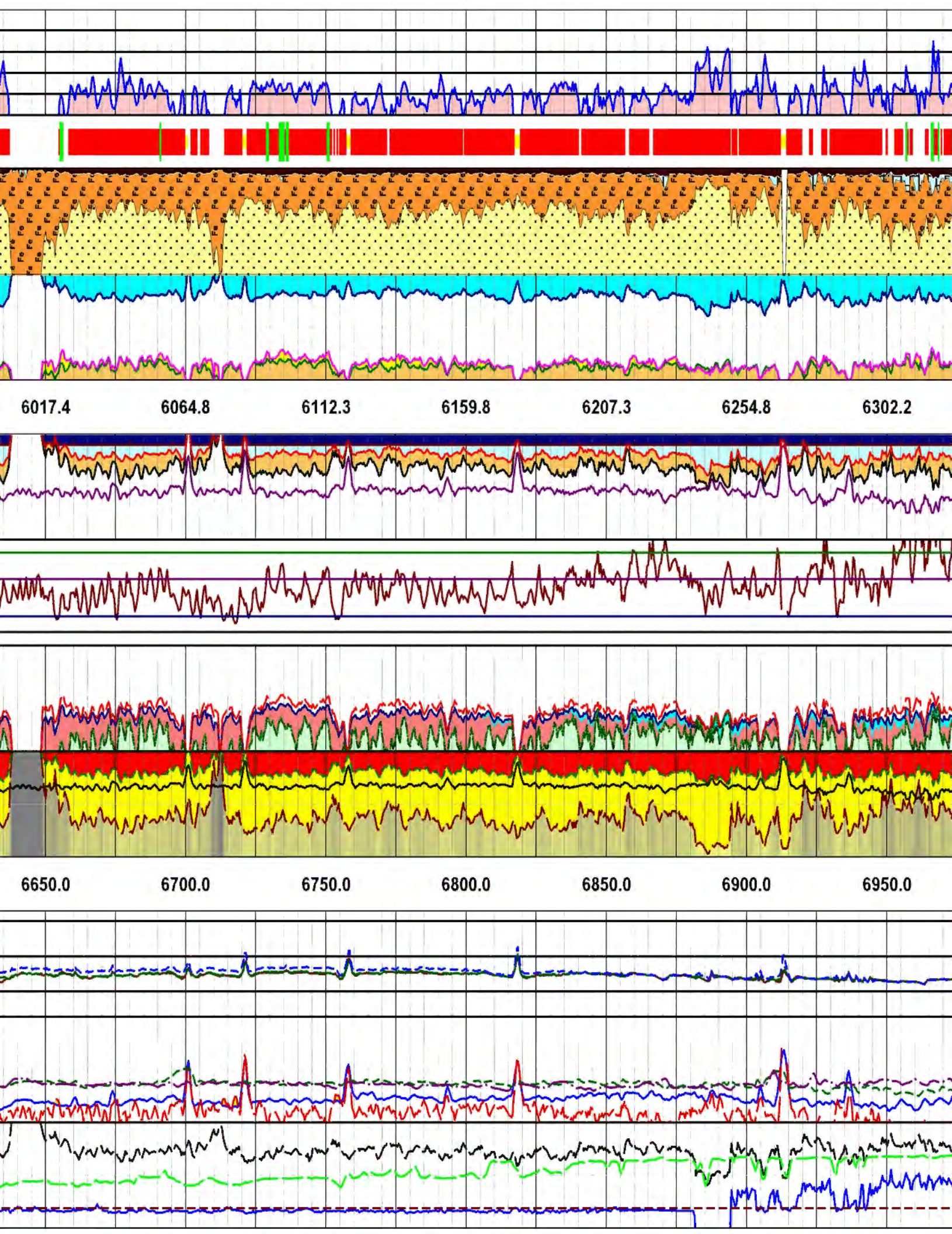
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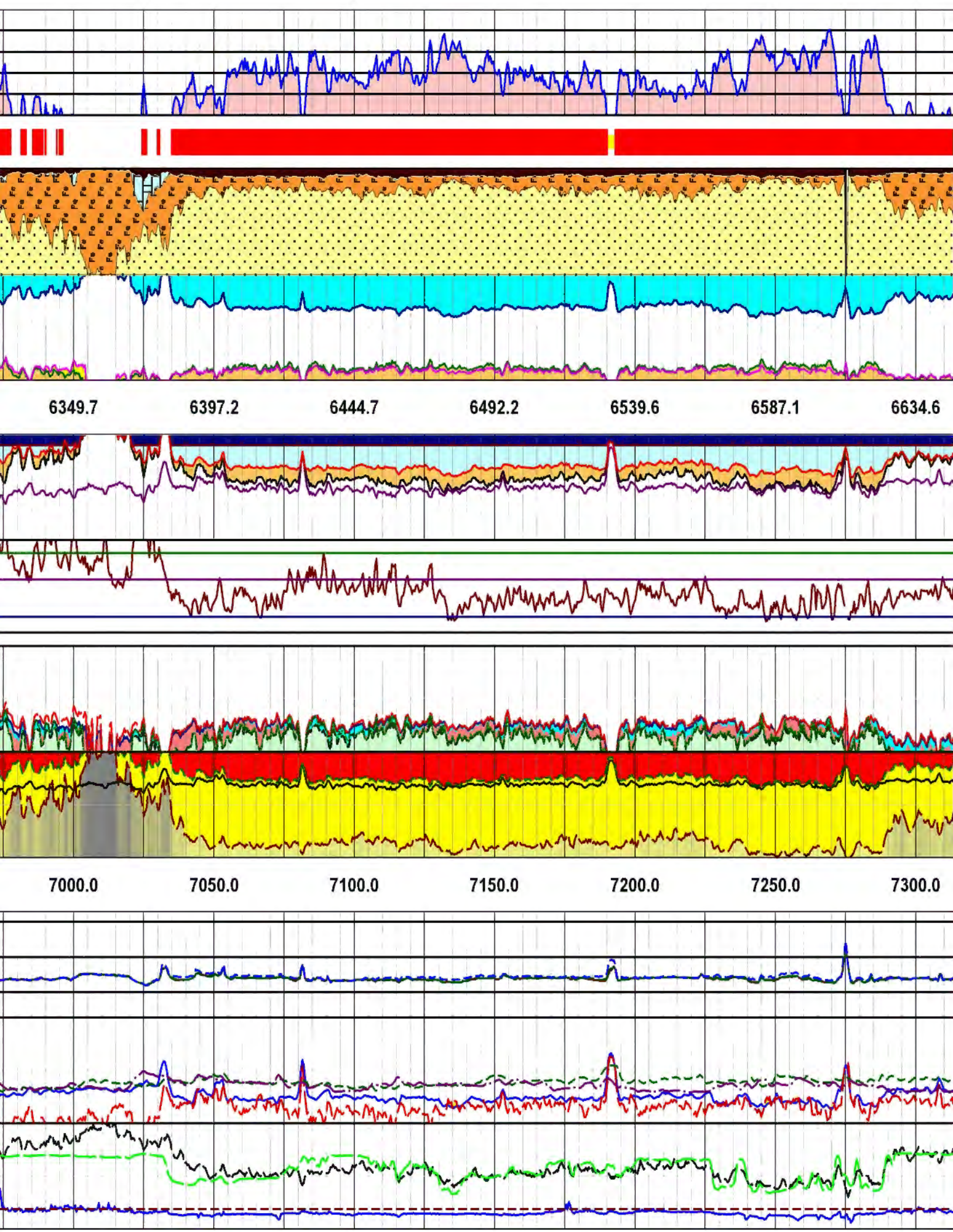
6950.0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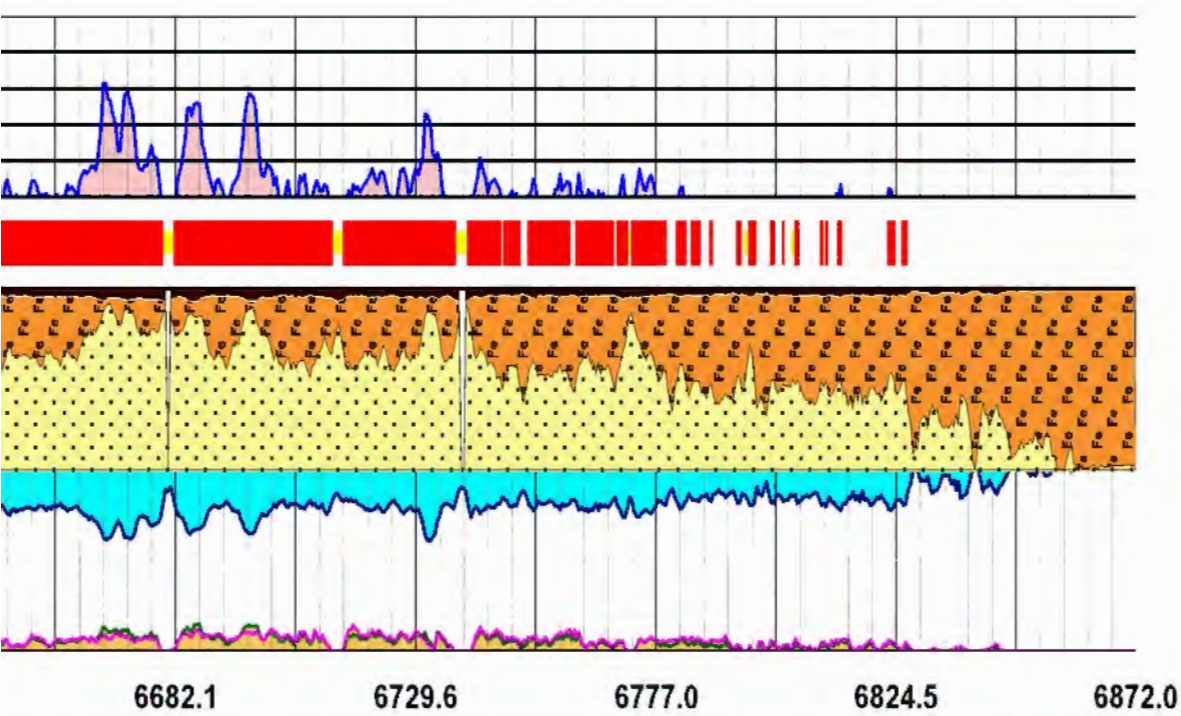

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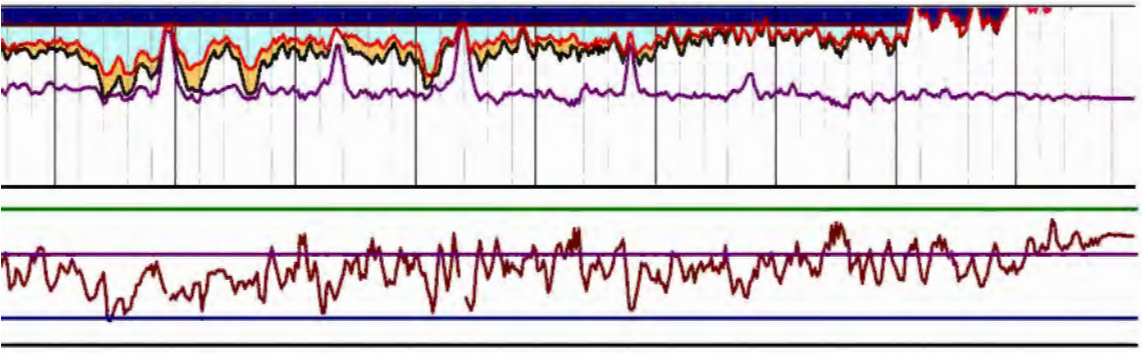

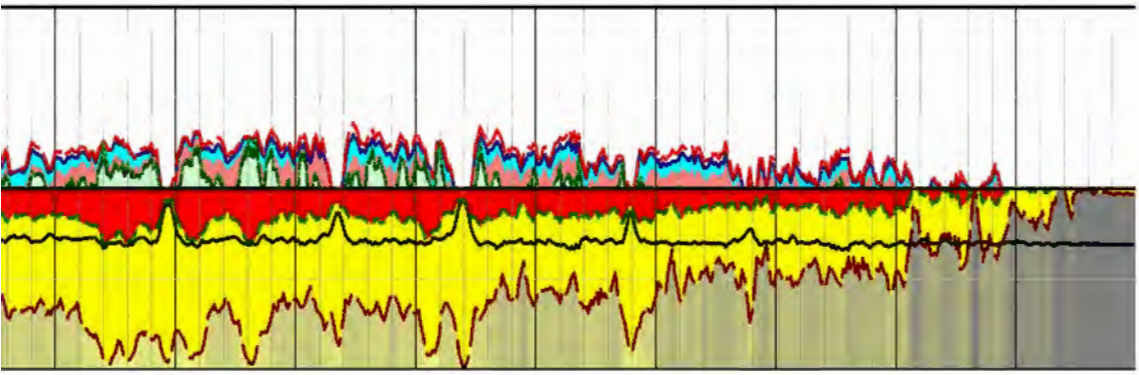

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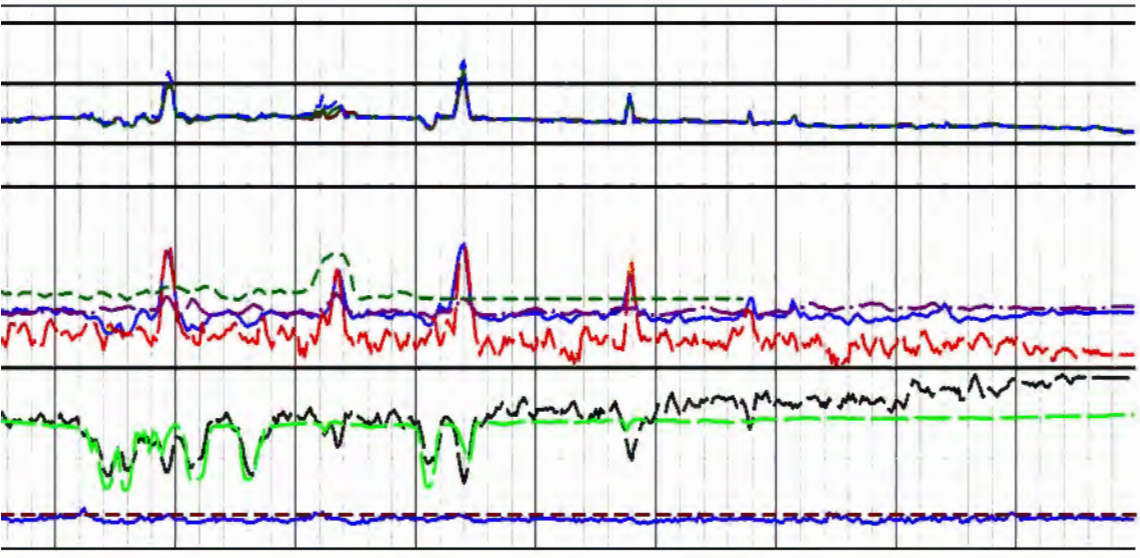

Schlumberger

Company: Princeton Natural Gas, LLC

Well: Citizen Green #1

Field: King Island Gas

County San Juaquin State: California

Platform Express

Array Induction / SP / GR / HSTS / MCFL

Density / Neutron

County	San Juaquin
Field:	King Island Gas
Location:	2670' S'ly ASL & 690' W'ly ARA
Well:	Citizen Green #1
Company:	Princeton Natural Gas, LLC

Location:
2670' S'ly ASL & 690' W'ly ARA
From the NE corner of section 28
X: 1733330.00 & Y: 576640.00 (NAD 27)

Elev.	K.B.	12.00 ft
	G.L.	-6.00 ft
	D.F.	11.00 ft

Permanent Datum:	Ground Level	Elev.:	-6.00 ft
Log Measured From:	Drill Floor	17.00 ft	above Perm.Datum
Drilling Measured From:	Drill Floor		

API Serial No.	28	Township:	Range:
07720688	28	3N	5E

Logging Date			19-Dec-2011			
Run Number			One			
Depth Driller			7570.00 ft			
Schlumberger Depth			7562.00 ft			
Bottom Log Interval			7554.00 ft			
Top Log Interval			516.00 ft			
Casing Driller Size @ Depth			8.625 in @ 517.00 ft			
Casing Schlumberger			516 ft			
Bit Size			7.875 in			
Type Fluid In Hole			Klaycon			
MUD	Density	Viscosity	9.2 lbm/gal	42 s		
	Fluid Loss	PH	5 cm3	6.4		
	Source of Sample		Active Tank			
RM @ Meas Temp			3.24 ohm.m @ 73.1 degF			
RMF @ Meas Temp			2.57 ohm.m @ 73.1 degF			
RMC @ Meas Temp			3.82 ohm.m @ 74.5 degF			
Source RMF	RMC		Pressed	Pressed		
RM @ BHT	RMF @ BHT		1.61 @ 154	1.28 @ 154		
Max Recorded Temperatures			154 degF			
Circulation Stopped	Time		20-Dec-2011	09:00:00		
Logger on Bottom	Time		20-Dec-2011	17:25:08		
Unit Number	Location:		7105	Bakersfield		
Recorded By			Derek Lukas			
Witnessed By			Wayne Rowe			

Disclaimer

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    11.3 Composite Summary
    11.4 Log (2 in)
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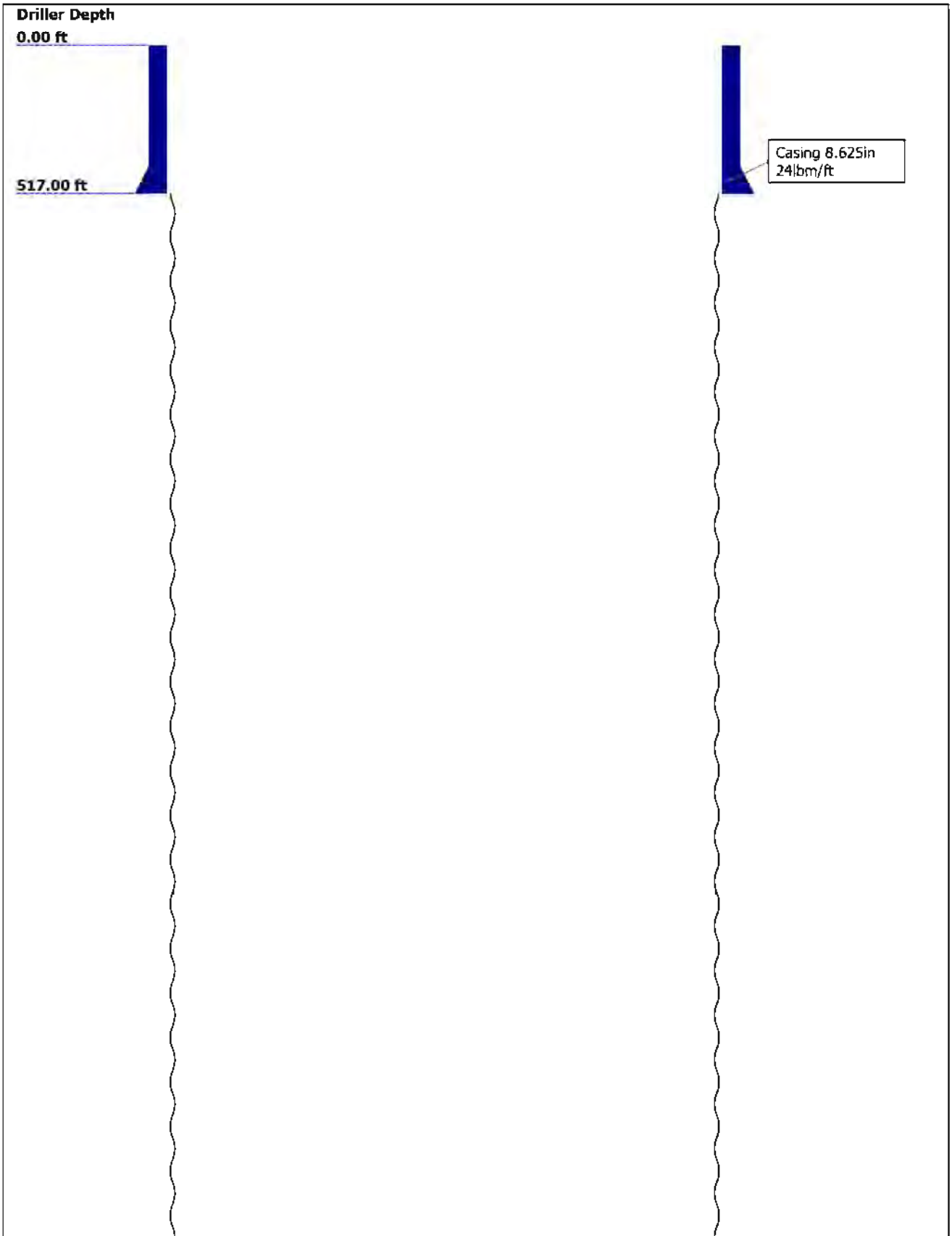
14. One Main Pass 5" = 100 ft Repeat
    14.1 Composite Summary
    14.2 Log (5 in RA)
15. One SP Check
    15.1 Integration Summary
    15.2 Software Version
    15.3 Composite Summary
    15.4 Log (sp check)
    15.5 Parameter Listing
16. One MCFL Check
    16.1 Integration Summary
    16.2 Software Version
    16.3 Composite Summary

12.1 Integration Summary
12.2 Software Version
12.3 Composite Summary
12.4 Log (Copy of 2 in)
12.5 Parameter Listing
13. One Main Pass 5" = 100 ft
13.1 Integration Summary
16.4 Log (PEX MCFL Box Check)
16.5 Parameter Listing
17. Calibration Report
18. Tail

Well Sketch





Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	7.875					
Top Driller (ft)	517					
Top Logger (ft)	516					
Bottom Driller (ft)	7570					
Bottom Logger (ft)	7562					
Casing						
Size (in)	8.625					
Weight (lbm/ft)	24					
Inner Diameter (in)	8.099					
Grade	J55					
Top Driller (ft)	0					
Top Logger (ft)	0					
Bottom Driller (ft)	517					
Bottom Logger (ft)	516					

Operational Run Summary

Parameter (unit)	**One**					
Date Log Started	19-Dec-2011					
Time Log Started	22:22:23					
Date Log Finished	20-Dec-2011					
Time Log Finished	21:52:02					
Top Log Interval (ft)	516.00					
Bottom Log Interval (ft)	7554.00					
Total Depth (ft)	7562.00					
Max Hole Deviation (deg)	0.00					
Azimuth of Max Deviation (deg)	0.00					
Bit Size (in)	7.875					
Logging Unit Number	7105					
Logging Unit Location	Bakersfield					
Recorded By	Derek Lukas					
Witnessed By	Wayne Rowe					

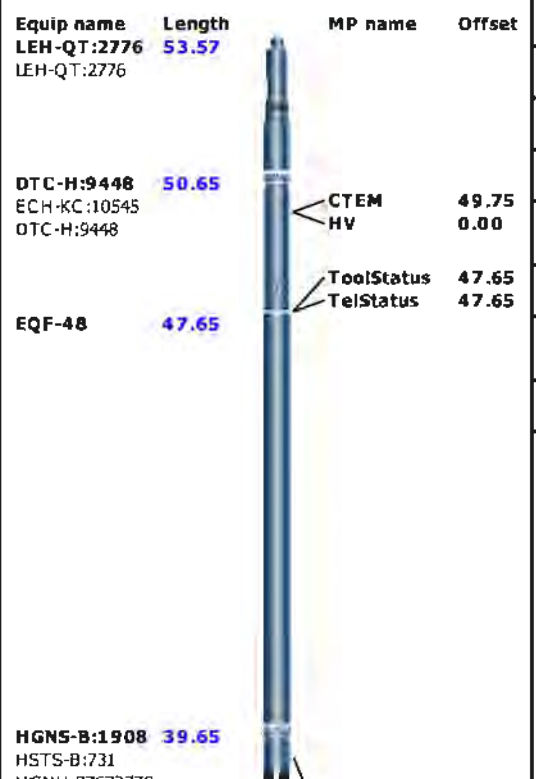
Service Order Number	BC0W-00238					

Borehole Fluids

Parameter(unit)	One					
Fluid Type	Water					
Fluid Name	Klaycon					
Max Recorded Temperatures (degF)	154					
Source of Sample	Active Tank					
Salinity (ppm)	320					
Density (lbm/gal)	9.2					
Viscosity (s)	42					
Fluid Loss (cm3)	5					
PH	6.4					
Date/Time Circulation Stopped	20-Dec-2011 09:00:00					
Date Logger on Bottom	20-Dec-2011					
Time Logger on Bottom	17:25:08					
Source RMF	Pressed					
RMC	Pressed					
RM @ Meas Temp (ohm.m@degF)	3.24 @ 73.1					
RMF @ Meas Temp (ohm.m@degF)	2.57 @ 73.1					
RMC @ Meas Temp (ohm.m@degF)	3.82 @ 74.5					
RM @ BHT (ohm.m@degF)	1.61 @ 154					
RMF @ BHT (ohm.m@degF)	1.28 @ 154					
RMC @ BHT (ohm.m@degF)	1.93 @ 154					
Total Solid (%)						
High Gravity Solids (%)						

Remarks and Equipment Summary

One: Toolstring



One: Remarks

One: Remarks
Run Number One
Toolstring ran as per tool sketch
Two 10" standoffs run on induction tool
Two 0.125" standoffs run on neutron tool
Sandstone matrix applied with matrix densit of 2.65 g/cc
ICV calculated based on FCD = 4.5"
Max tempearture was 154 degF found at TD from temp sub
Total chlorides: 320 ppm



Lengths are in ft
Maximum Outer Diameter = 9.000 in
Line: Sensor Location, Value: Gating Offset
All measurements are relative to TOOL_ZERO

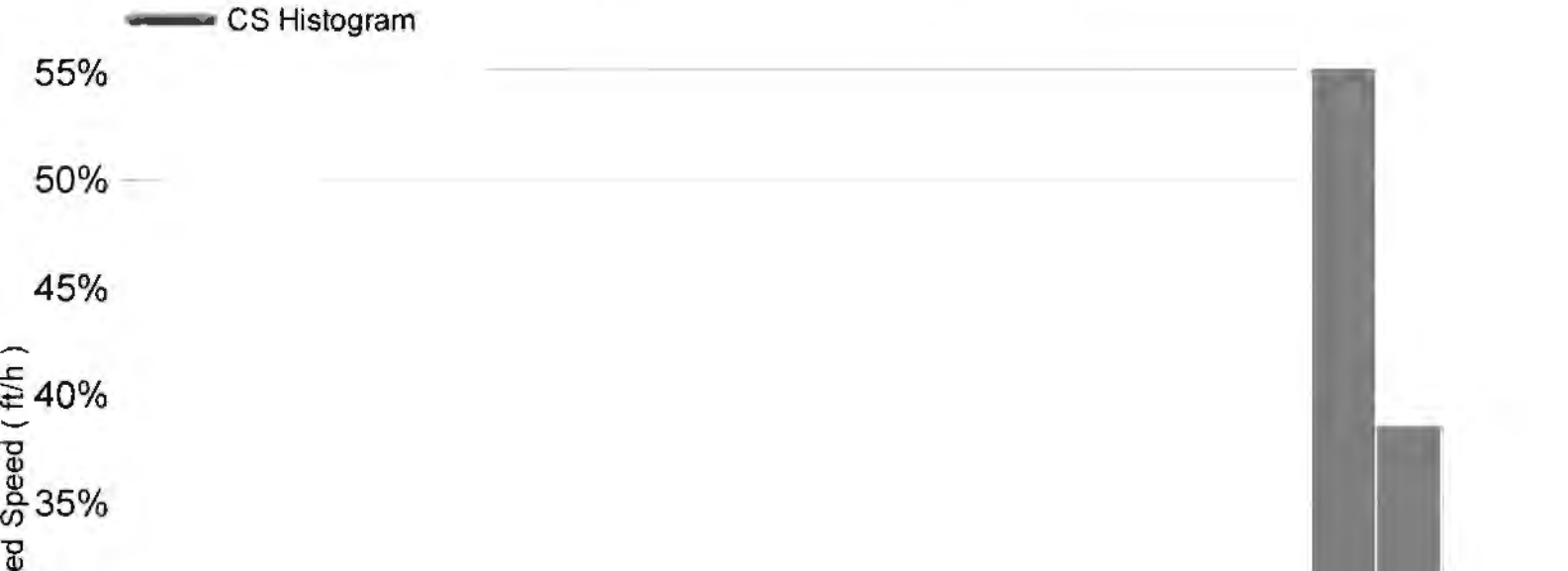
Depth Summary

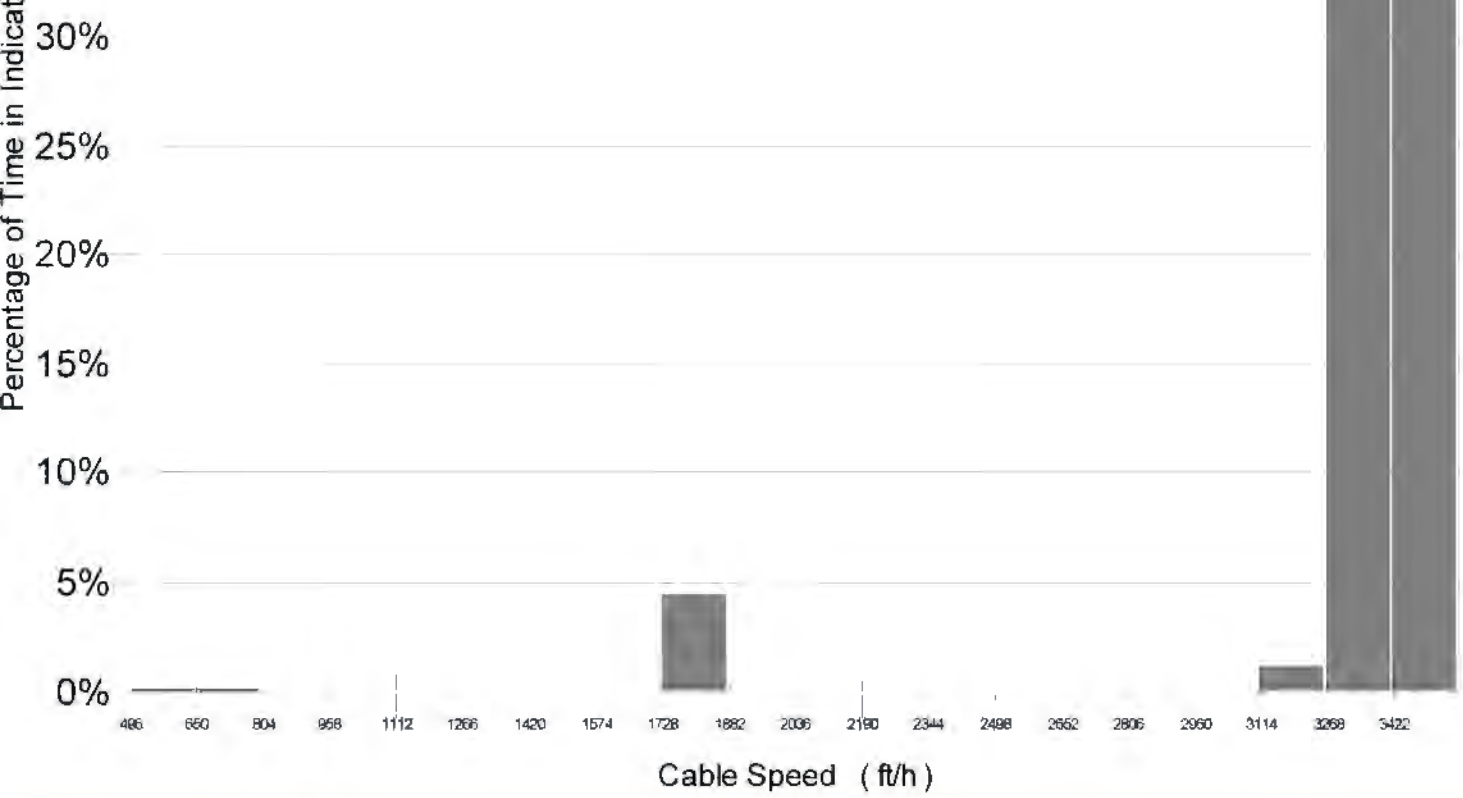
Depth Control Parameters	One		

Conveyance Type	Wireline		
Stretch Correction (ft)	14.60		
Tool Zero Reference Check at Surface (ft)	-14.00		
Rig Type	Double		
Depth Remark Parameters	**One**		
Depth Remark 1	All Schlumberger depth policy procedures applied		
Depth Remark 2	IDW used as primary depth reference, Z-chart used as secondary		
Depth Remark 3	RULS and RULB not applied due to well conditions		
Depth Measuring Device	**One**		
Type	IDW-C		
Serial Number	5021		
Calibration Date	18-DEC-2011		
Calibrator Serial Number	185		
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-7		
Wheel Correction 2	-2		
Tension Device	**One**		
Type	CMTD-B/A		
Serial Number	5021		
Calibration Date	03-nov-2011		
Calibrator Serial Number	185		
Calibration Points	10		
Calibration RMS	18		
Calibration Peak Error	32		
Logging Cable	**One**		
Type	7-46A-XS		
Serial Number	U710198B		
Logging Cable Length (ft)	24000.00		

Cable Speed Histogram

Index Range: From 7575.00 to 367.00 ft





One

Main Pass 2" = 100 ft

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit

Software Version

Acquisition System	Version
MaxWell	3.0.9609.0
Application Patch	SP-20110816-3.0.9609.1150

Computation	Description	Version
Borehole	Borehole Ensemble provides common Borehole Parameters and Channels	3.0.9609.0
HENVIR	Computation Ensemble for the HGNS Neutron environmental corrections	3.0.9609.0
PEQL	Platform Express Quicklook	3.0.9609.0

Tool Elements	Description	Software Version	Firmware Version
HMCA-B	HILT Master Communication Assembly, 125 degC	3.0.9609.0	3.0
HRGD-B	HILT Resistivity Gamma-Ray Density Device, 125 degC	3.0.9609.0	3.0
AHIS	Array Induction Sonde - H	3.0.9609.1150	
HGNS-B	HILT Gamma-Ray and Neutron Sonde, 125 degC	3.0.9609.0	2.0
HRCC-B	HILT High-Resolution Control Cartridge, 125 degC	3.0.9609.0	2.0

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift
One	Log[3]:Up	Up	366.35 ft	7574.85 ft	20-Dec-2011 6:53:20 PM	20-Dec-2011 9:07:14 PM	14.58 ft

All depths are referenced to toolstring zero

Log

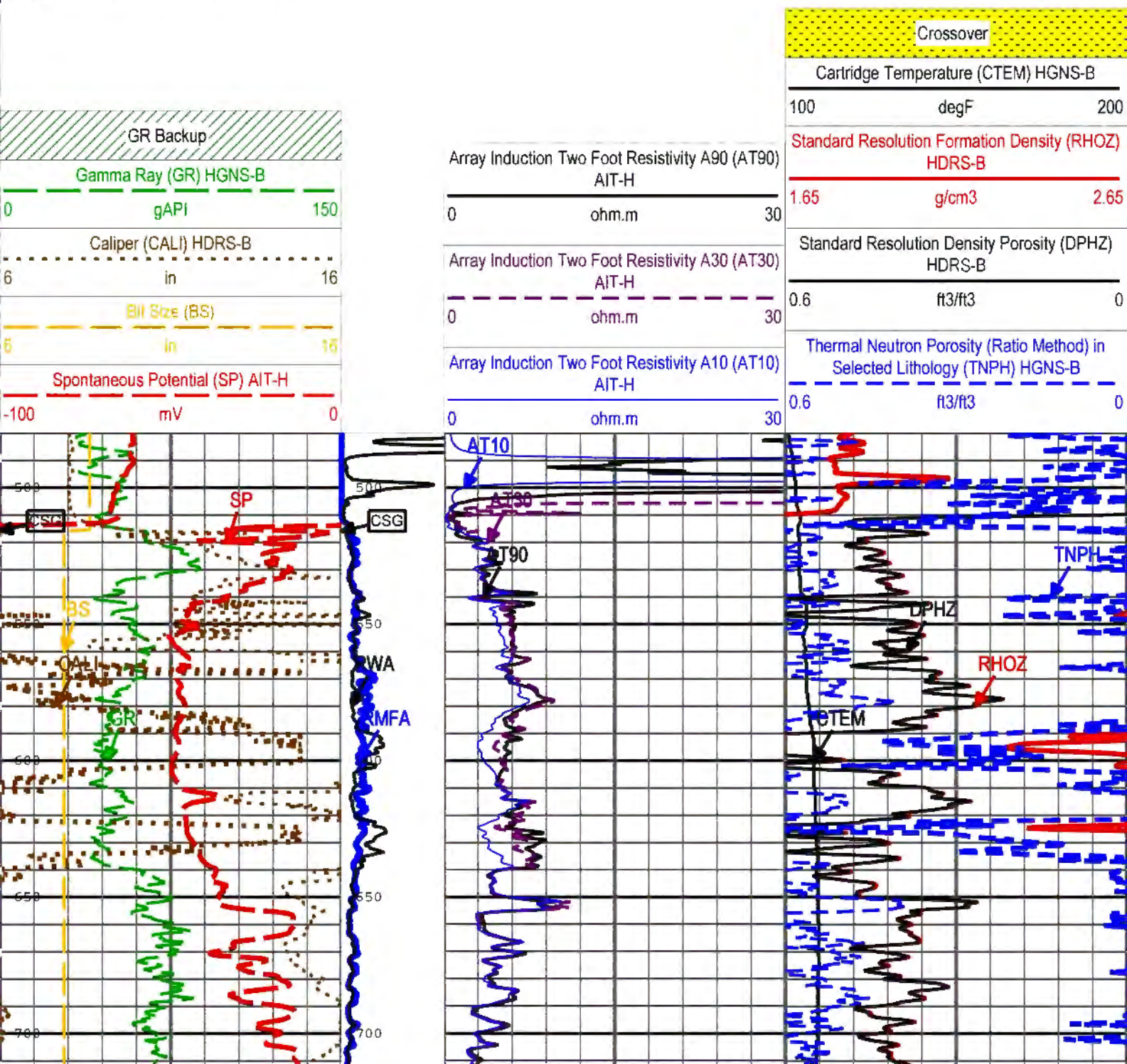
One: Log[3]:Up 4CA9F5AE-D314-4D61-B9EA-FBFF6559E5F2

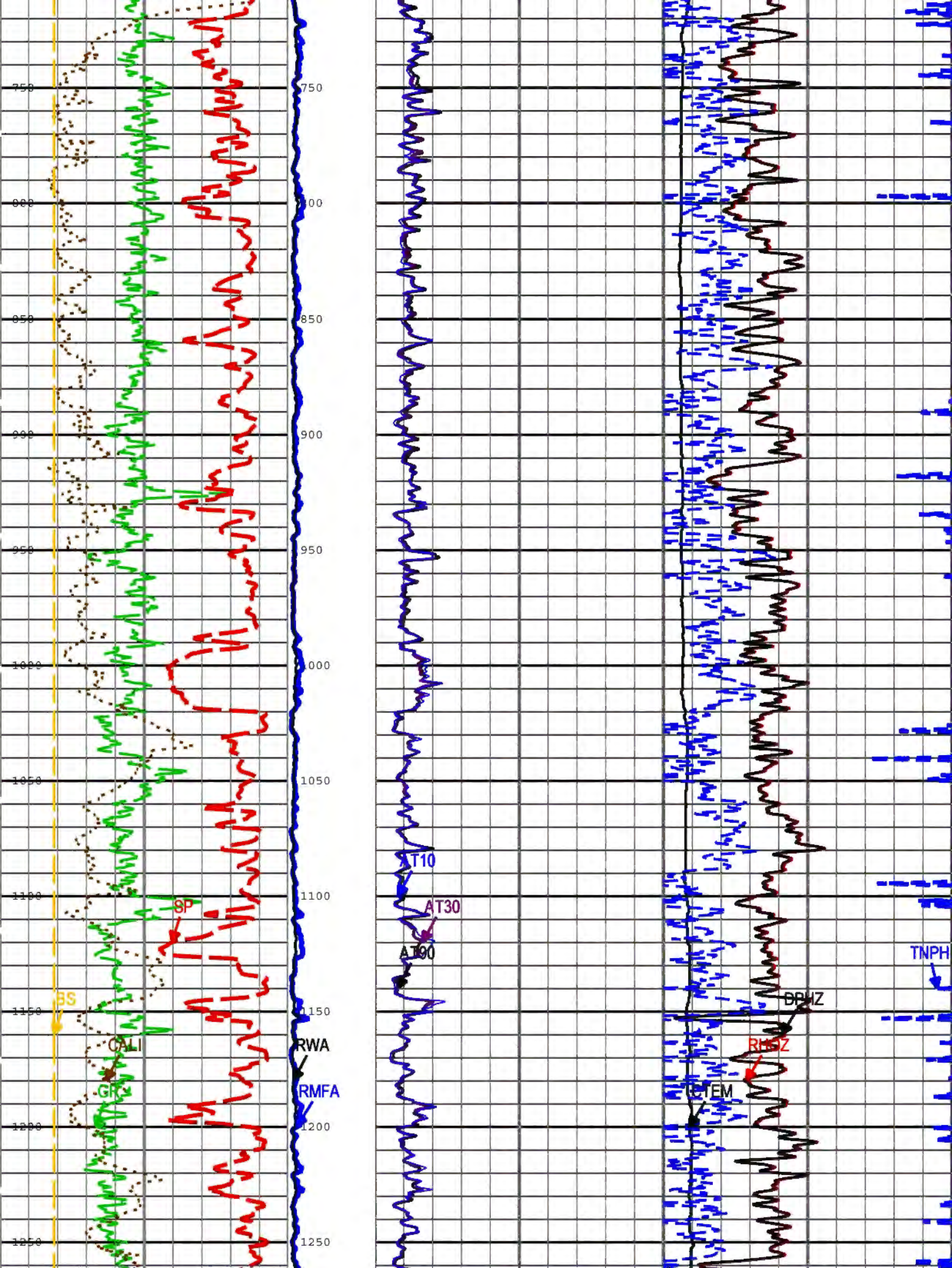
Description: HGNS standard resolution porosities for Platform Express Format: Log (2 in) Index Scale: 2 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:22

Channel	Source	Sampling

AT10	AIT-H:AHIS:AHIS	3in
AT30	AIT-H:AHIS:AHIS	3in
AT90	AIT-H:AHIS:AHIS	3in
BS	Borehole	6in
CALI	HDRS-B:HRCC-B:HRCC-B	1in
CTEM	HGNS-B:HGNS-B:HMCA-B	6in
DPHZ	HDRS-B:HRMS-B:HRGD-B	2in
GR	HGNS-B:HGNS-B:HGNS-B	6in
RHOZ	HDRS-B:HRMS-B:HRGD-B	2in
RMFA	PEQL	6in
RWA	PEQL	6in
SP	AIT-H:AHIS:AHIS	6in
TIME_1900	WLWorkflow	0.1in
TNPH	HGNS-B:HGNS-B:HGNS-B	6in

TIME_1900 - Time Marked every 60.00 (s)

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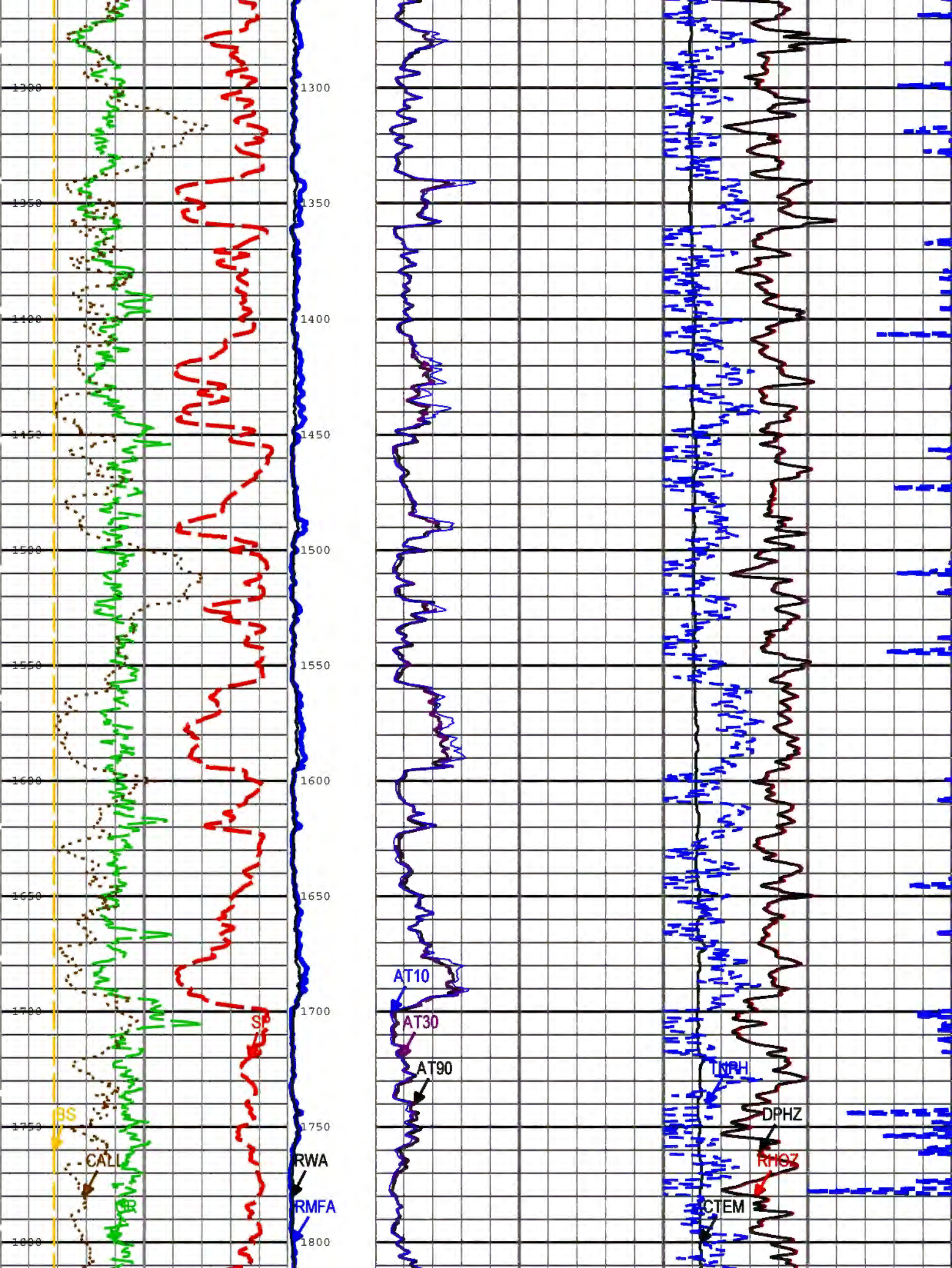
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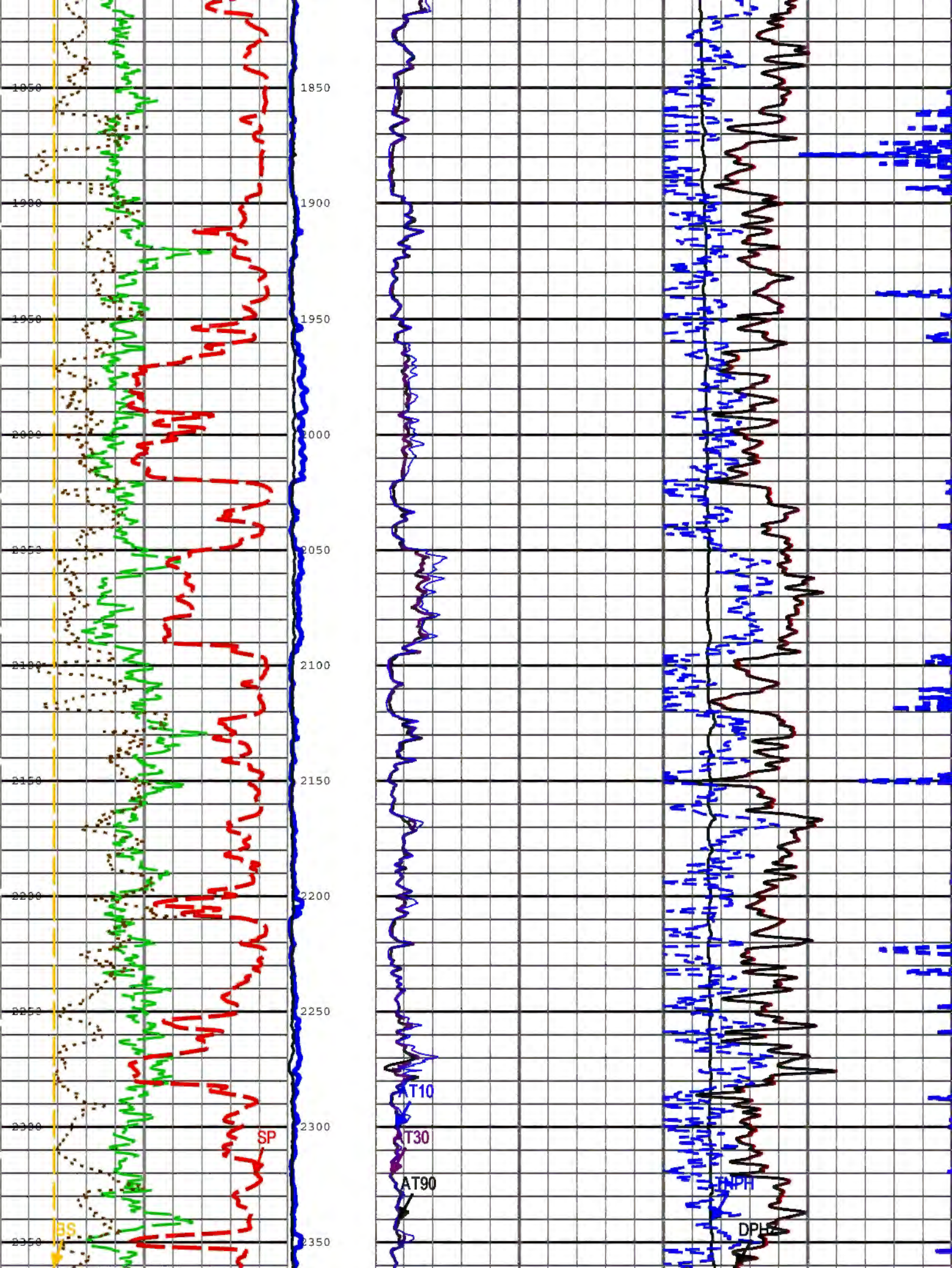
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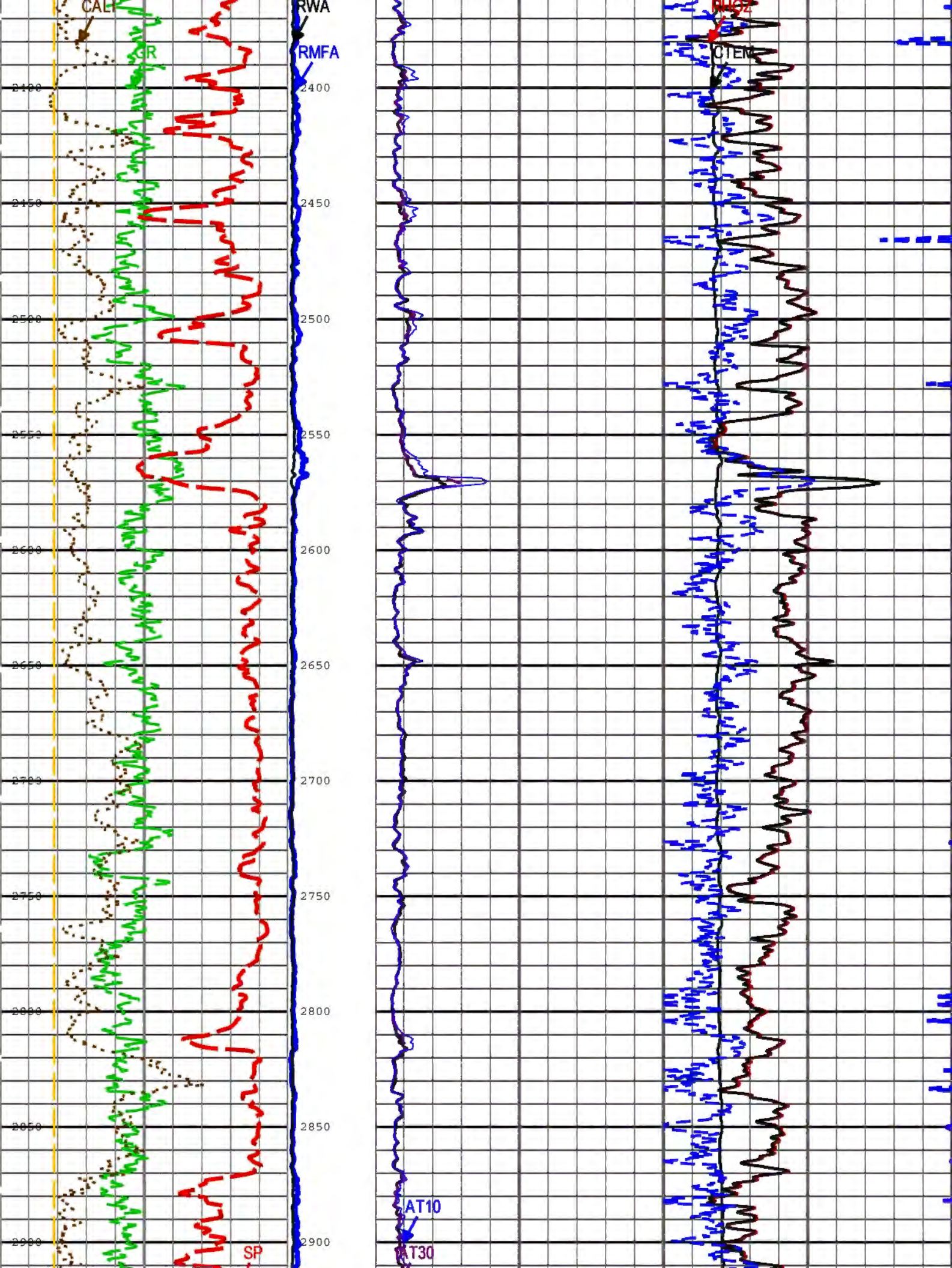
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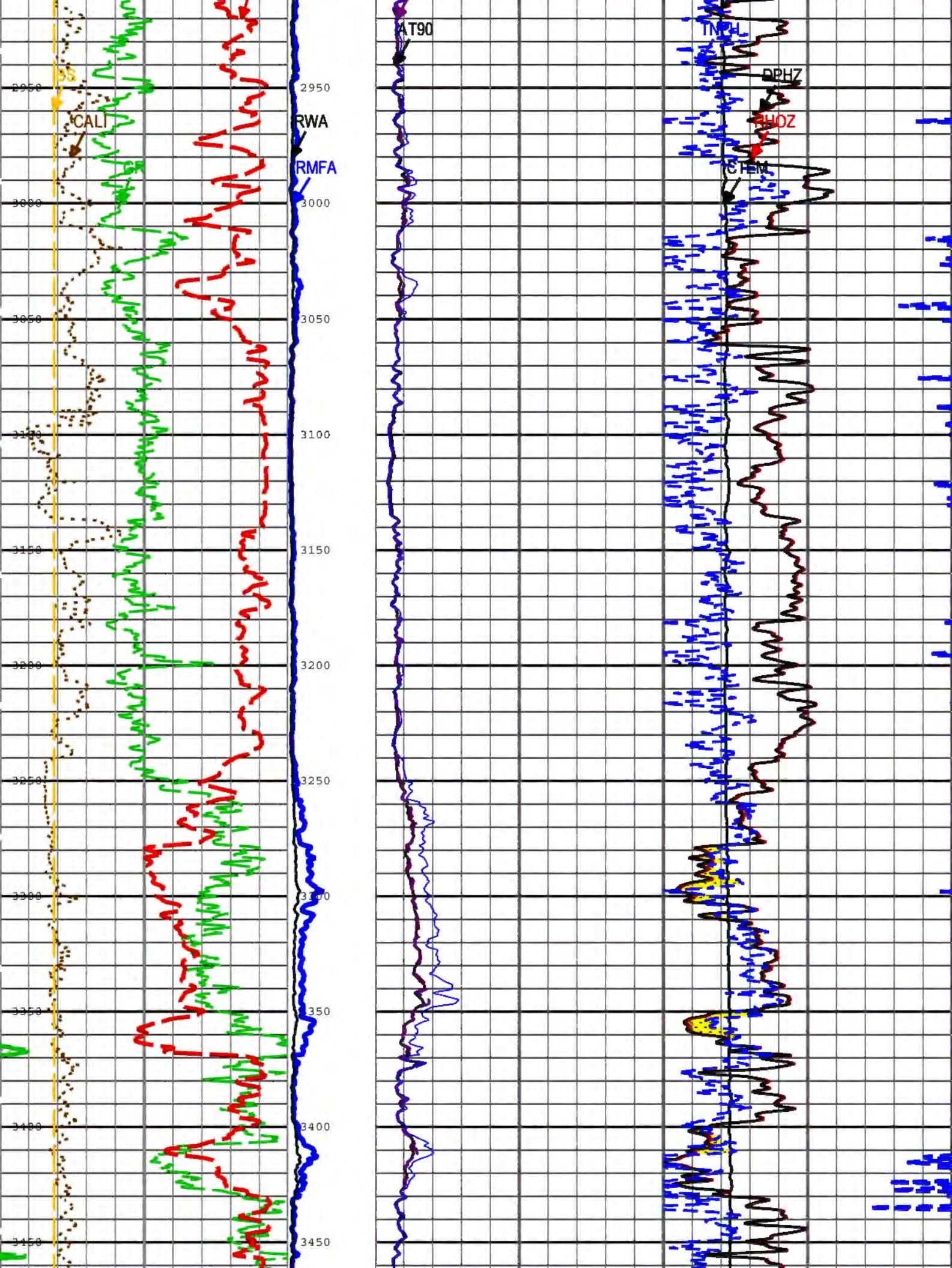
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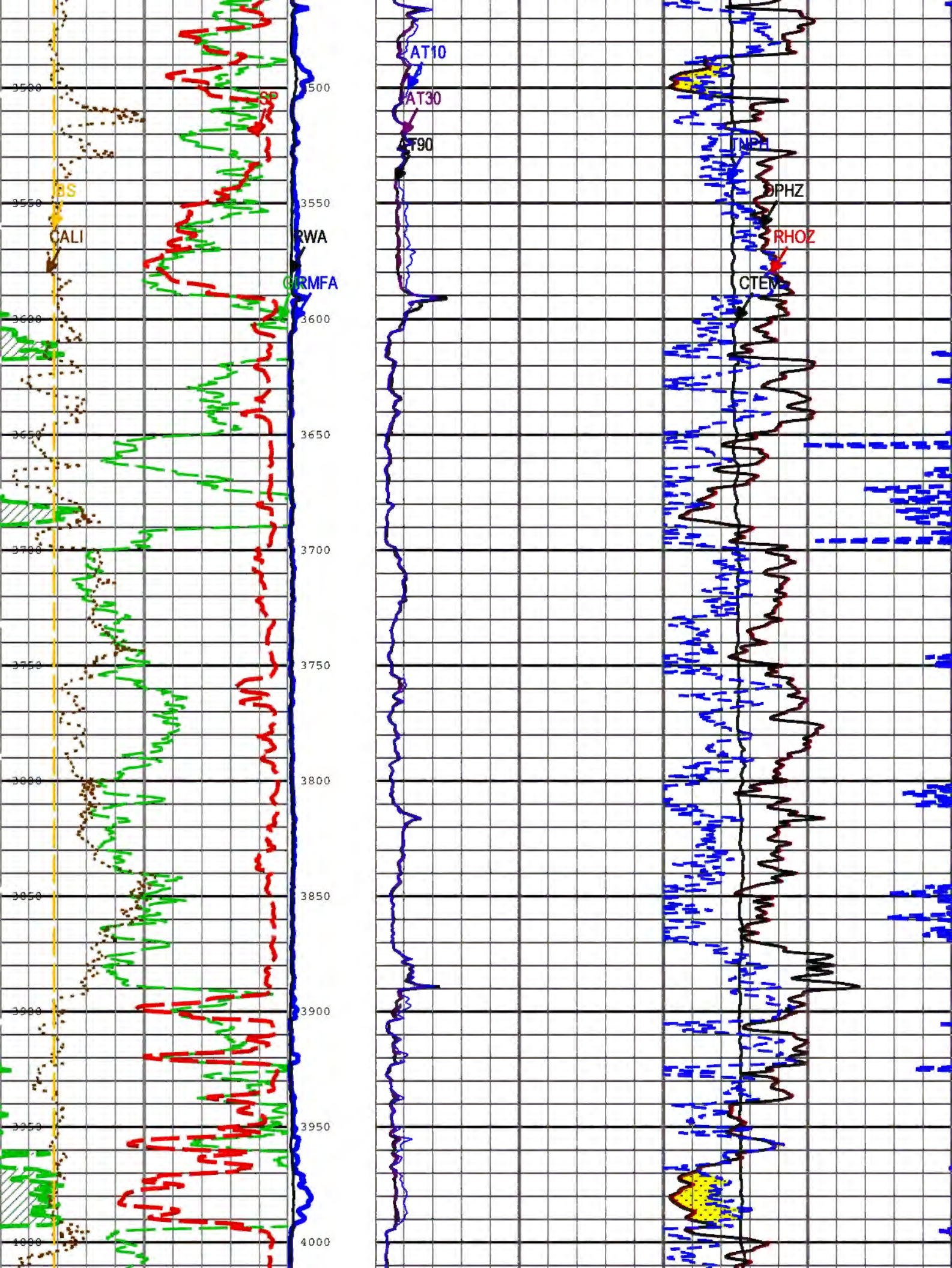
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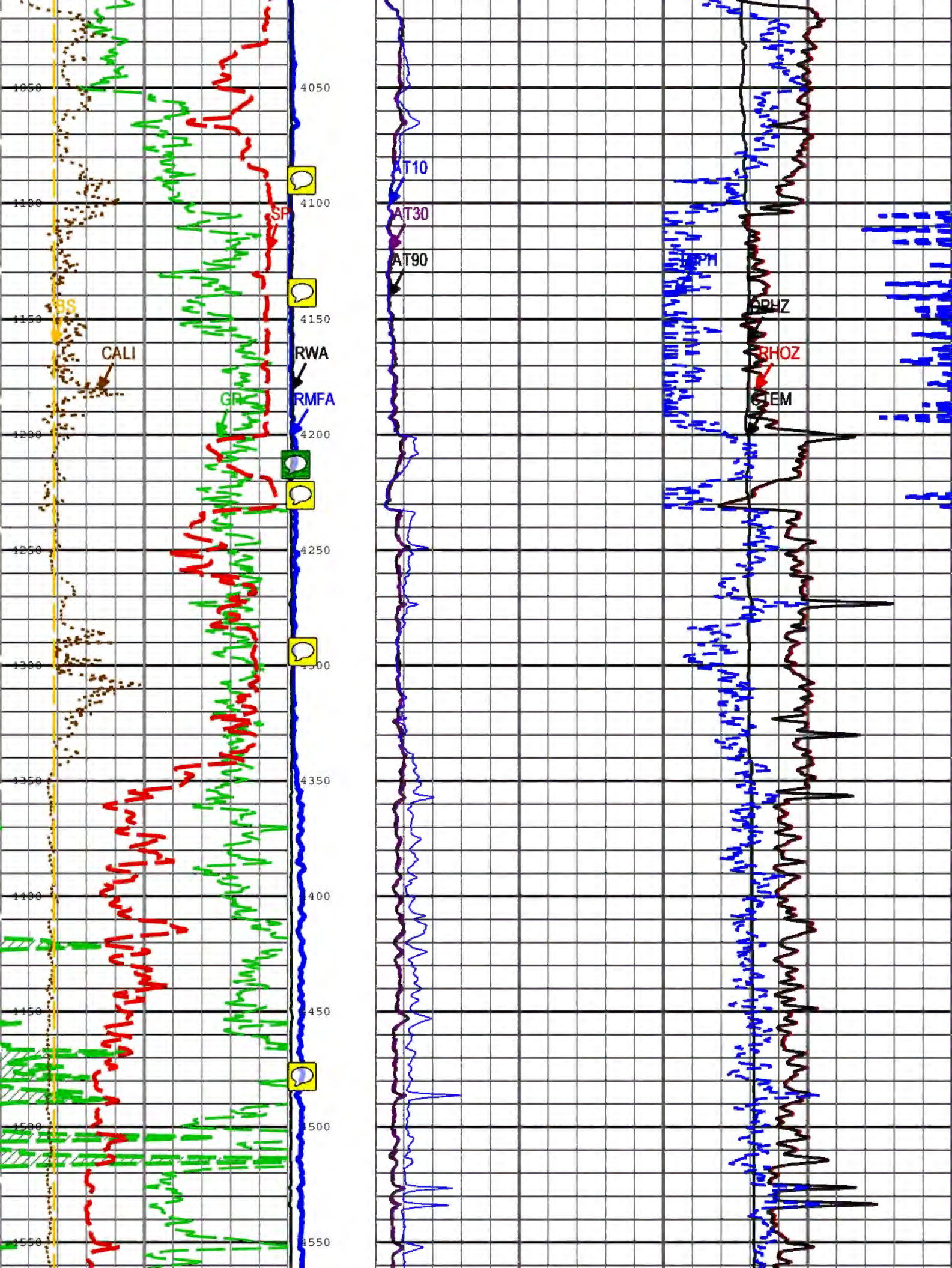
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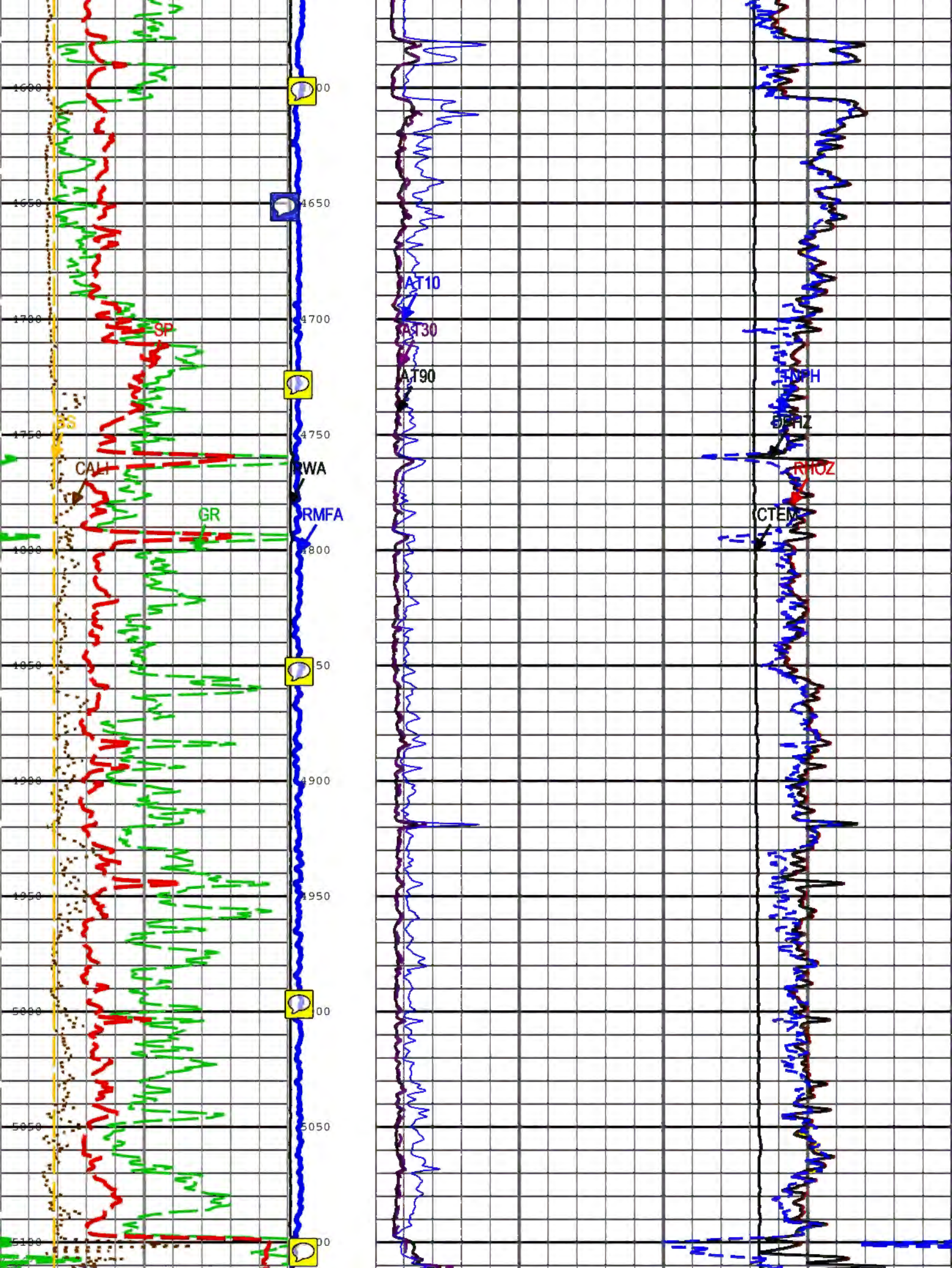
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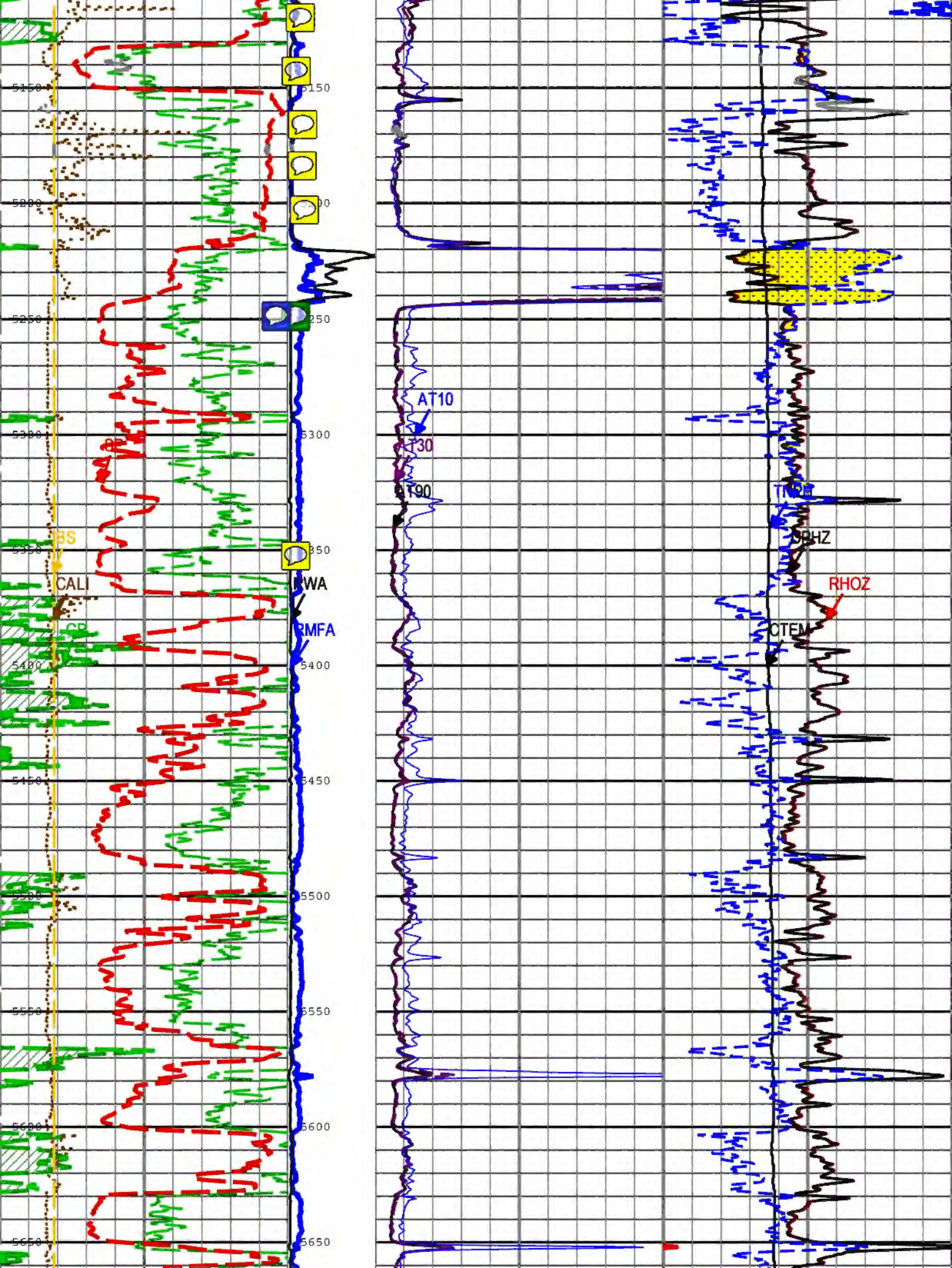
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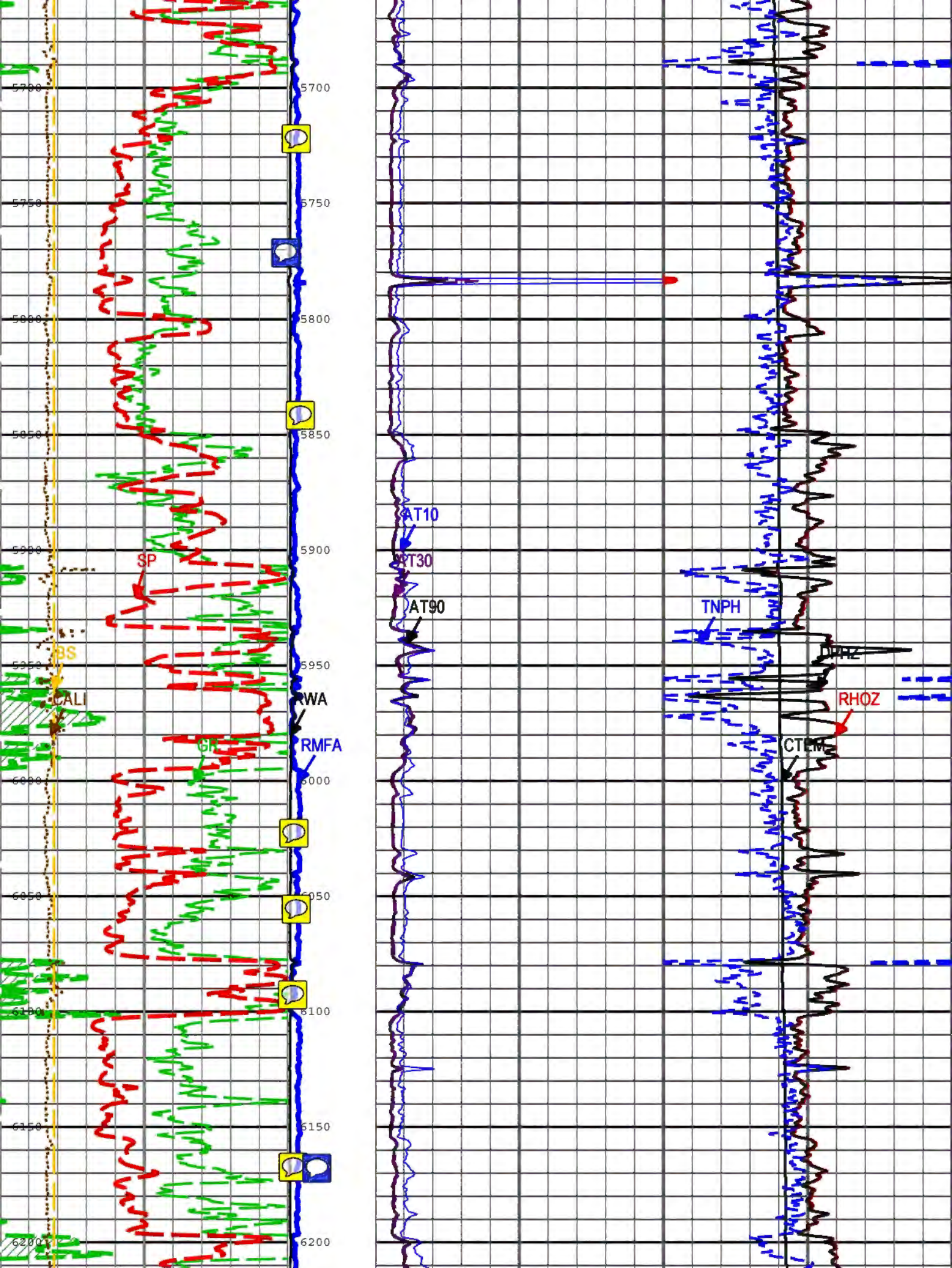
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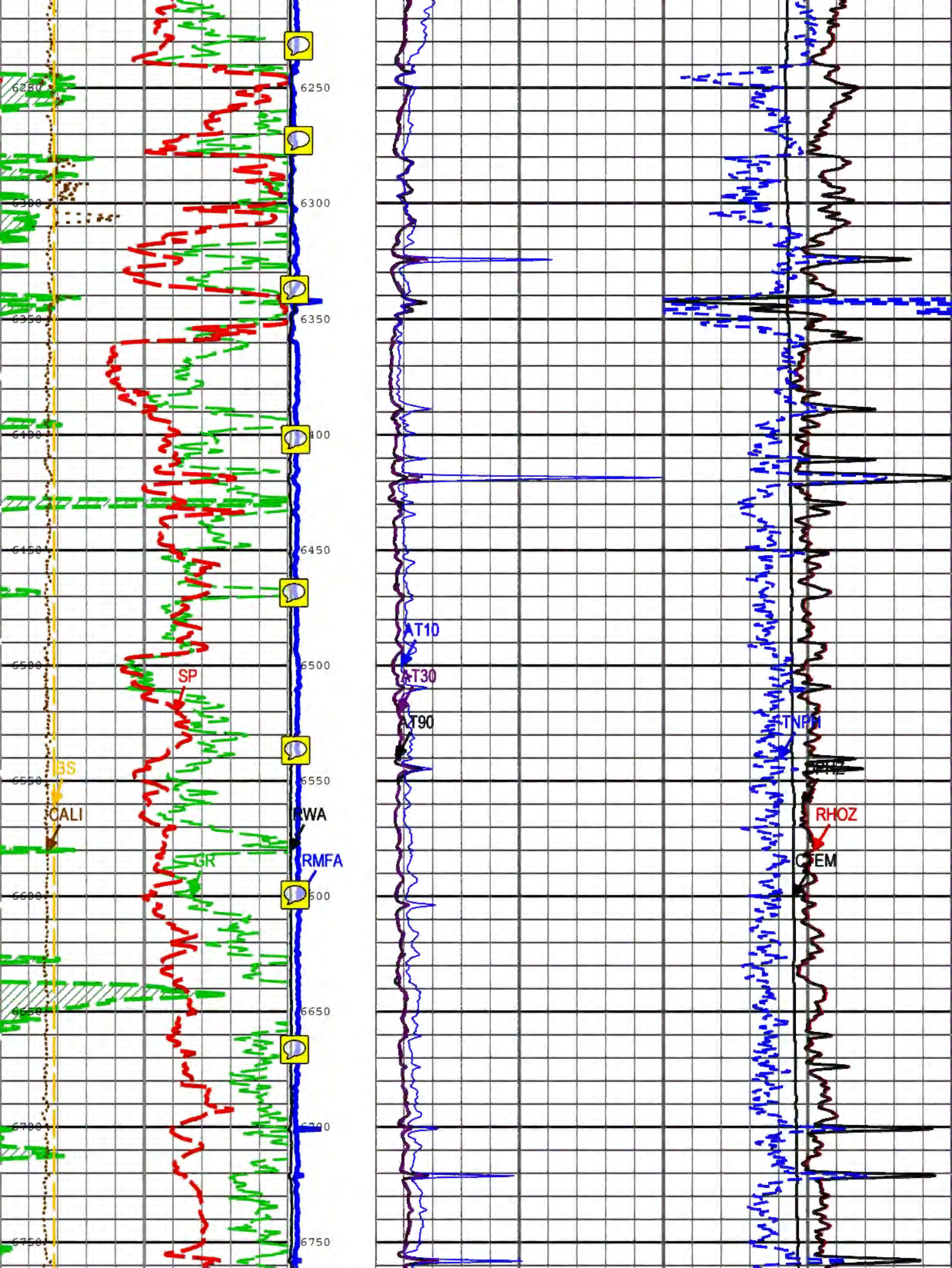
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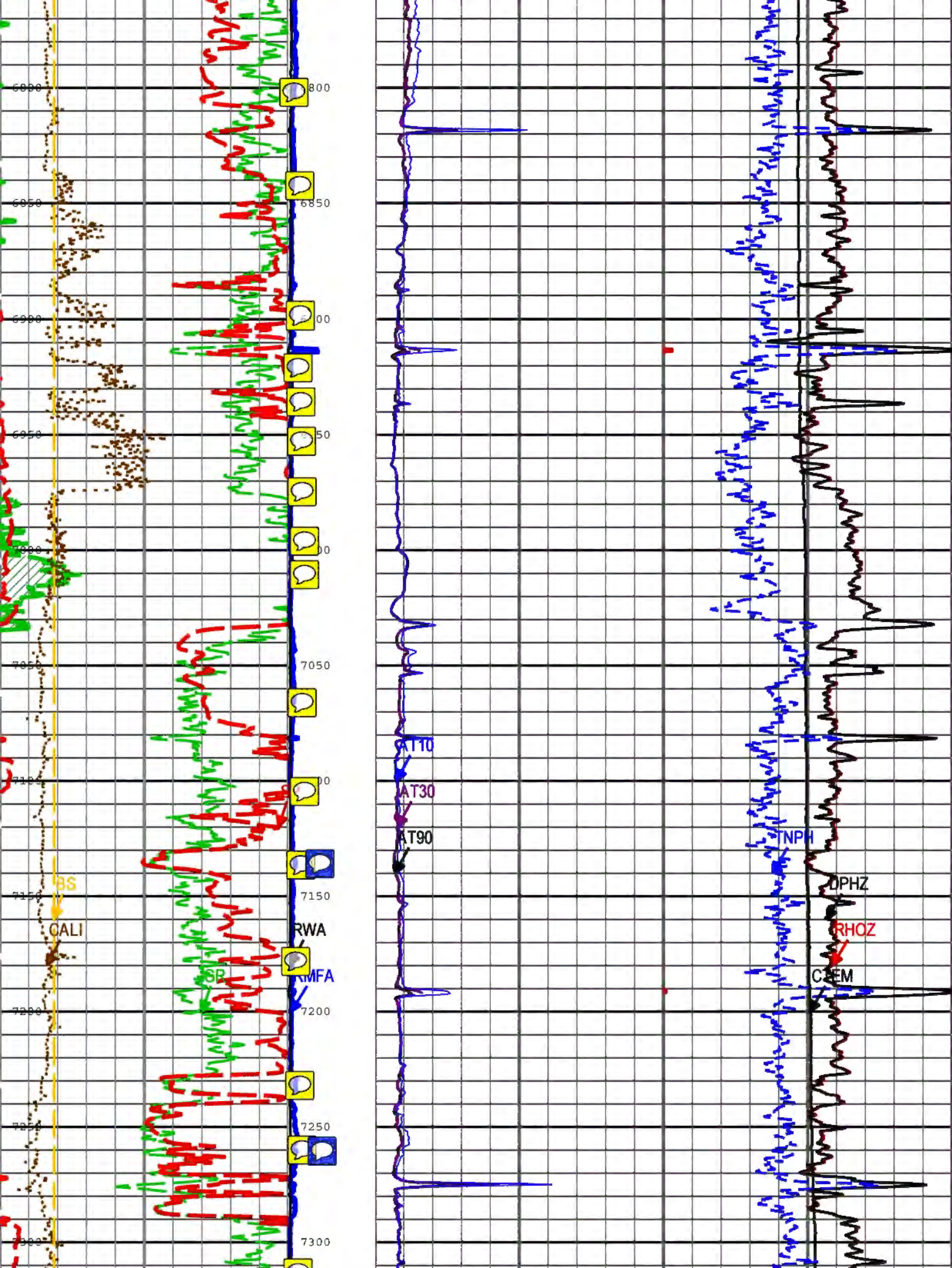
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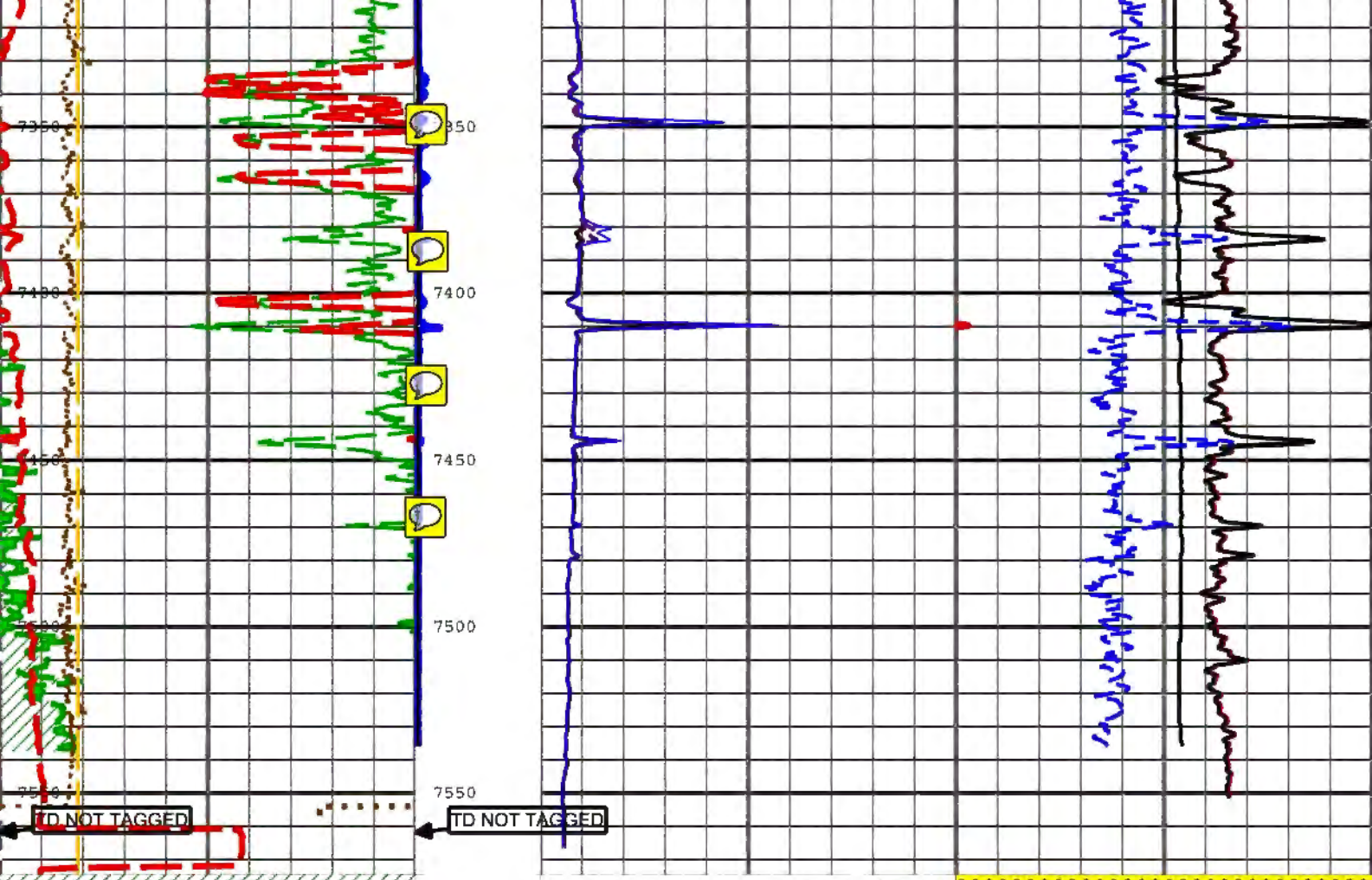


GR Backup

Gamma Ray (GR) HGNS-B
0 gAPI 150

Caliper (CALI) HDRS-B
6 in 16

Bit Size (BS)
6 in 16

Spontaneous Potential (SP) AIT-H
-100 mV 0

Array Induction Two Foot Resistivity A90 (AT90) AIT-H
0 ohm.m 30

Array Induction Two Foot Resistivity A30 (AT30) AIT-H
0 ohm.m 30

Array Induction Two Foot Resistivity A10 (AT10) AIT-H
0 ohm.m 30

Crossover

Cartridge Temperature (CTEM) HGNS-B
100 degF 200

Standard Resolution Formation Density (RHOZ) HDRS-B
1.65 g/cm3 2.65

Standard Resolution Density Porosity (DPHZ) HDRS-B
0.6 ft3/ft3 0

Thermal Neutron Porosity (Ratio Method) in Selected Lithology (TNPH) HGNS-B
0.6 ft3/ft3 0

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (2 in) Index Scale: 2 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:22

Channel Processing Parameters

Parameter	Description	ToolPath	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-H:AHIS:AHIS	Compute Standoff	
ABLM	Array Induction Basic Logs Mode	AIT-H:AHIS:AHIS	Normal	
ACDE	Array Induction Casing Detection Enable	AIT-H:AHIS:AHIS	No	
BARI	Barite Mud Presence Flag	Borehole	No	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	COMPLETION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	320	ppm

CALI_SHIFT	CALI Supplementary Offset	HDRS-B:HRCC-B:HRCC-B	0.157	in
CBLO	Casing Bottom (Logger)	COMPLETION	516	ft
CDEN	Cement Density	HGNS-B:HGNS-B:HGNS-B	2	g/cm3
DC_MODE	Depth Correction Mode	DepthCorrection	Real-time	
DFD	Drilling Fluid Density	Borehole	9.2	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	Klaycon	
DHC	Density Hole Correction	HDRS-B:HRMS-B:HRGD-B	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	6126.75	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	BS	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-B:HGNS-B:HGNS-B	Yes	
M	Exponent M of the Archie Formation Factor - Porosity Equation	Borehole	2	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	73.1	degF
N	N Exponent in SW Formula	Borehole	2	
RMFS	Resistivity of Mud Filtrate Sample	Borehole	2.57	ohm.m
RW	Connate Water Resistivity	Borehole	1	ohm.m
SP_SHIFT	SP Shift	AIT-H:AHIS:AHIS	-30	mV
SPDR	SP Drift Per Foot	AIT-H:AHIS:AHIS	0	mV/ft
TWS	Connate Water Temperature	Borehole	68	degF

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	0	480	516
BS	7.875	516	7574.5

All depth are actual.

Tool Control Parameters

Parameter	Description	ToolPath	Value	Unit
HMCA_BRD_TYPE	HMCA Board Type	HGNS-B:HGNS-B:HMCA-B	0	
HRGD_BRD_TYPE	HRGD Board Type	HDRS-B:HRMS-B:HRGD-B	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLWorkflow	3600	ft/h

One

Fluid Resistivities

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit

Software Version

Acquisition System	Version
MaxWell	3.0.9609.0
Application Patch	SP-20110816-3.0.9609.1150

Computation	Description	Version
Borehole	Borehole Ensemble provides common Borehole Parameters and Channels	3.0.9609.0
PEQL	Platform Express Quicklook	3.0.9609.0

Tool Elements	Description	Software Version	Firmware Version
AHIS	Array Induction Sonde - H	3.0.9609.1150	
HGNS-B	HILT Gamma-Ray and Neutron Sonde, 125 degC	3.0.9609.0	2.0
HRCC-B	HILT High-Resolution Control Cartridge, 125 degC	3.0.9609.0	2.0

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift
One	Log[3]:Up	Up	366.35 ft	7574.85 ft	20-Dec-2011 6:53:20 PM	20-Dec-2011 9:07:14 PM	14.58 ft

All depths are referenced to toolstring zero

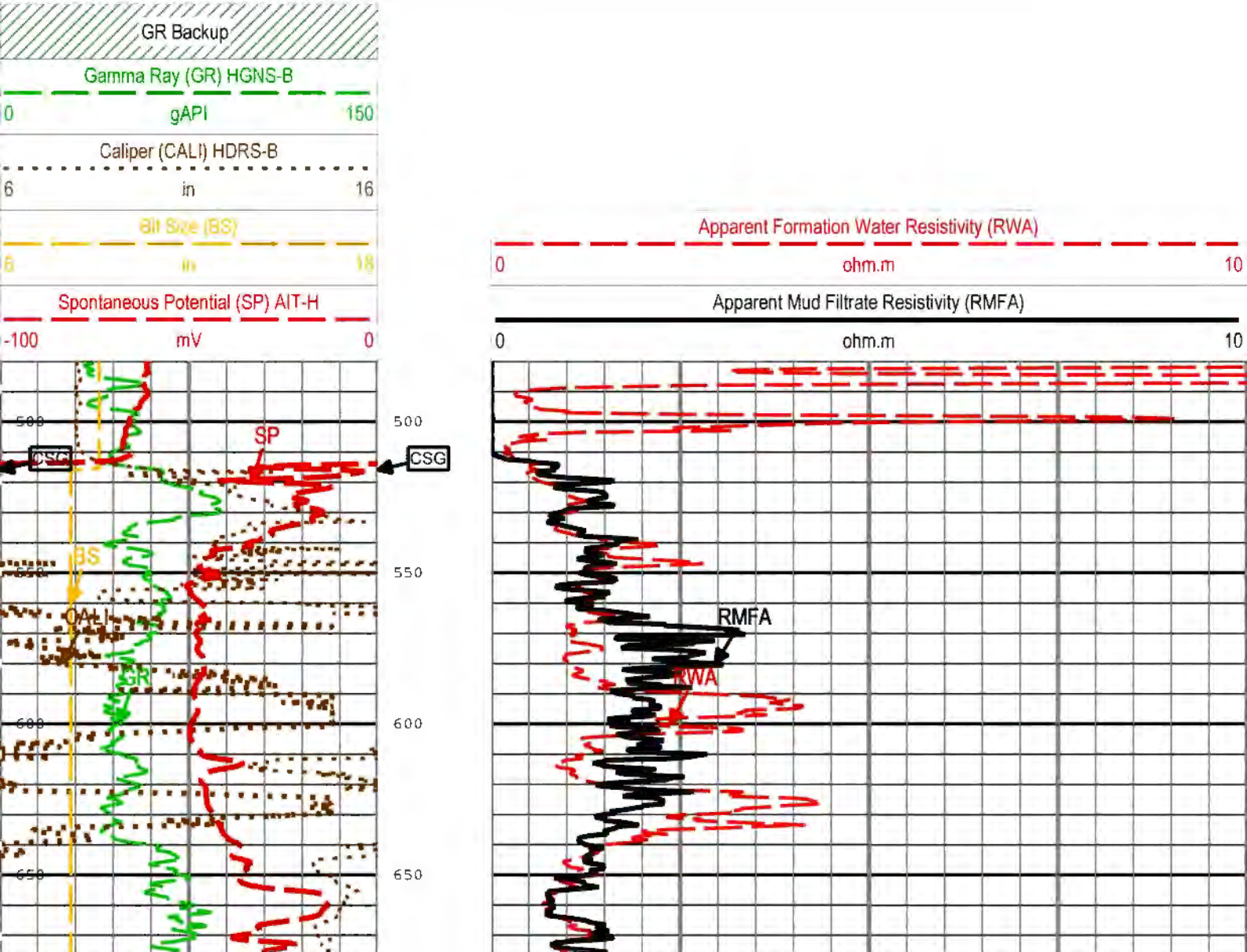
Log

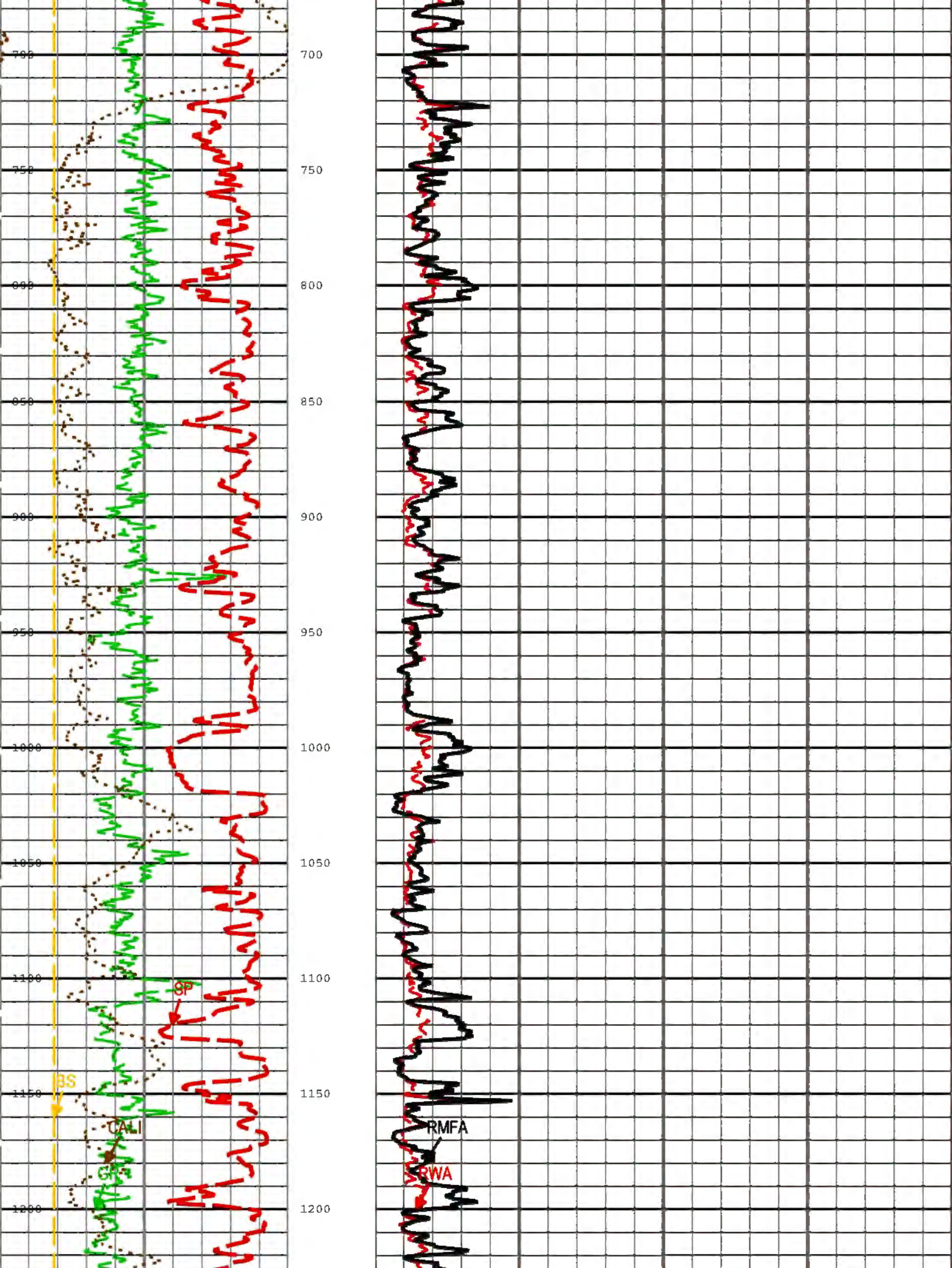
One: Log[3]:Up 4CA9F5AE-D314-4D61-B9EA-FBFF6559E5F2

Description: HGNS standard resolution porosities for Platform Express Format: Log (Copy of 2 in) Index Scale: 2 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:29

Channel	Source	Sampling
BS	Borehole	6in
CALI	HDRS-B:HRCC-B:HRCC-B	1in
GR	HGNS-B:HGNS-B:HGNS-B	6in
RMFA	PEQL	6in
RWA	PEQL	6in
SP	AIT-H:AHIS:AHIS	6in
TIME_1900	WLWorkflow	0.1in

TIME_1900 - Time Marked every 60.00 (s)

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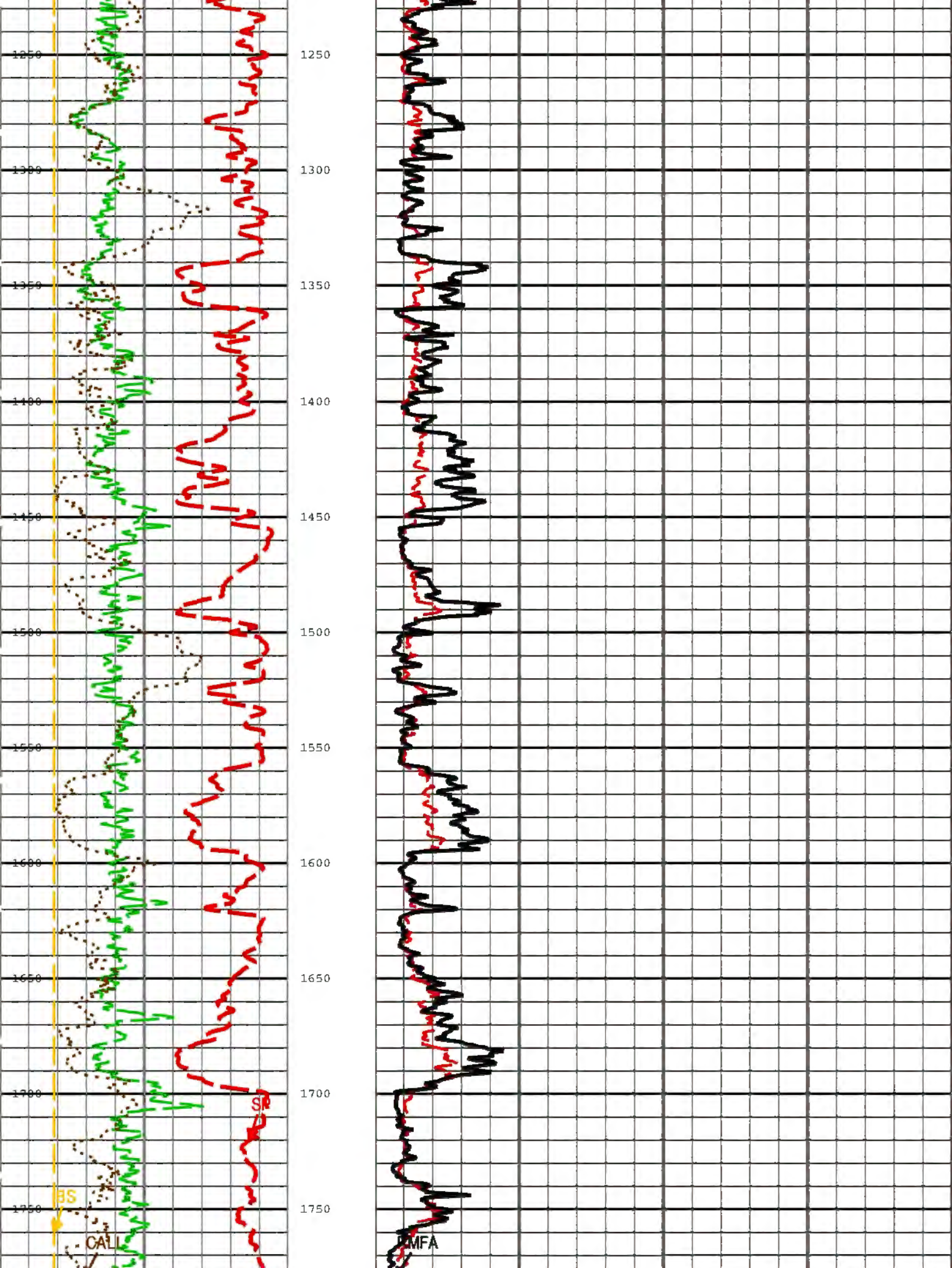
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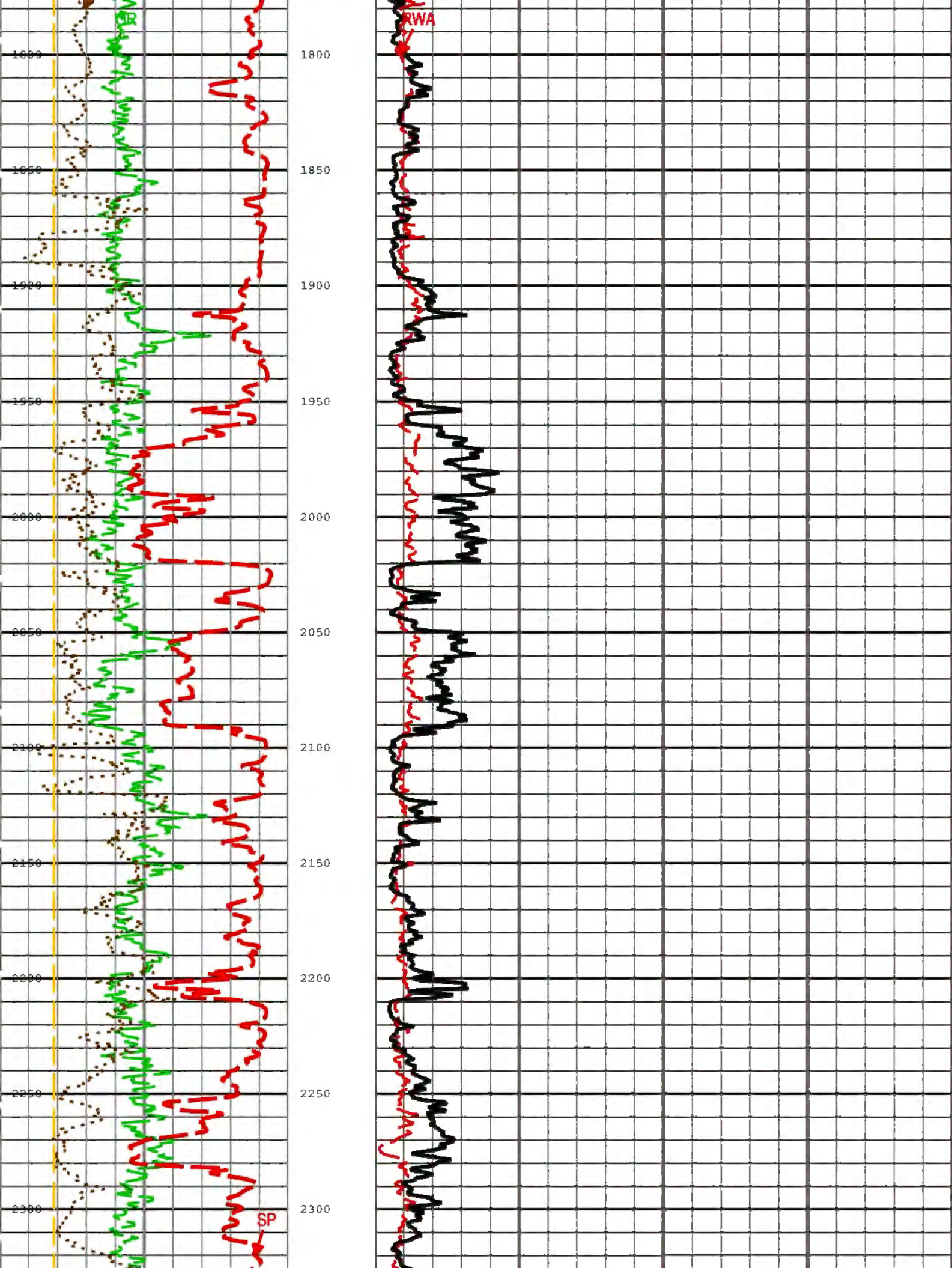
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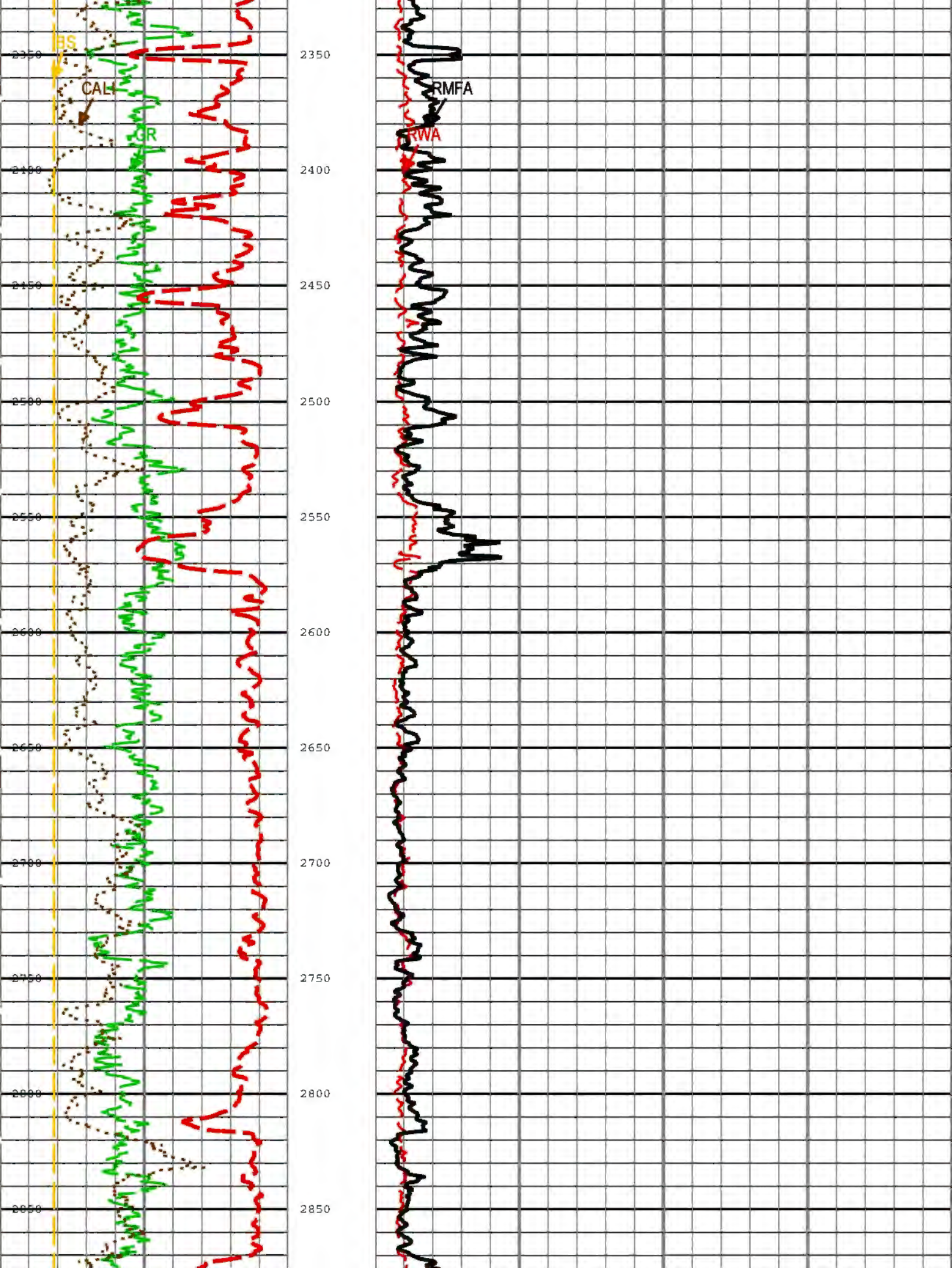
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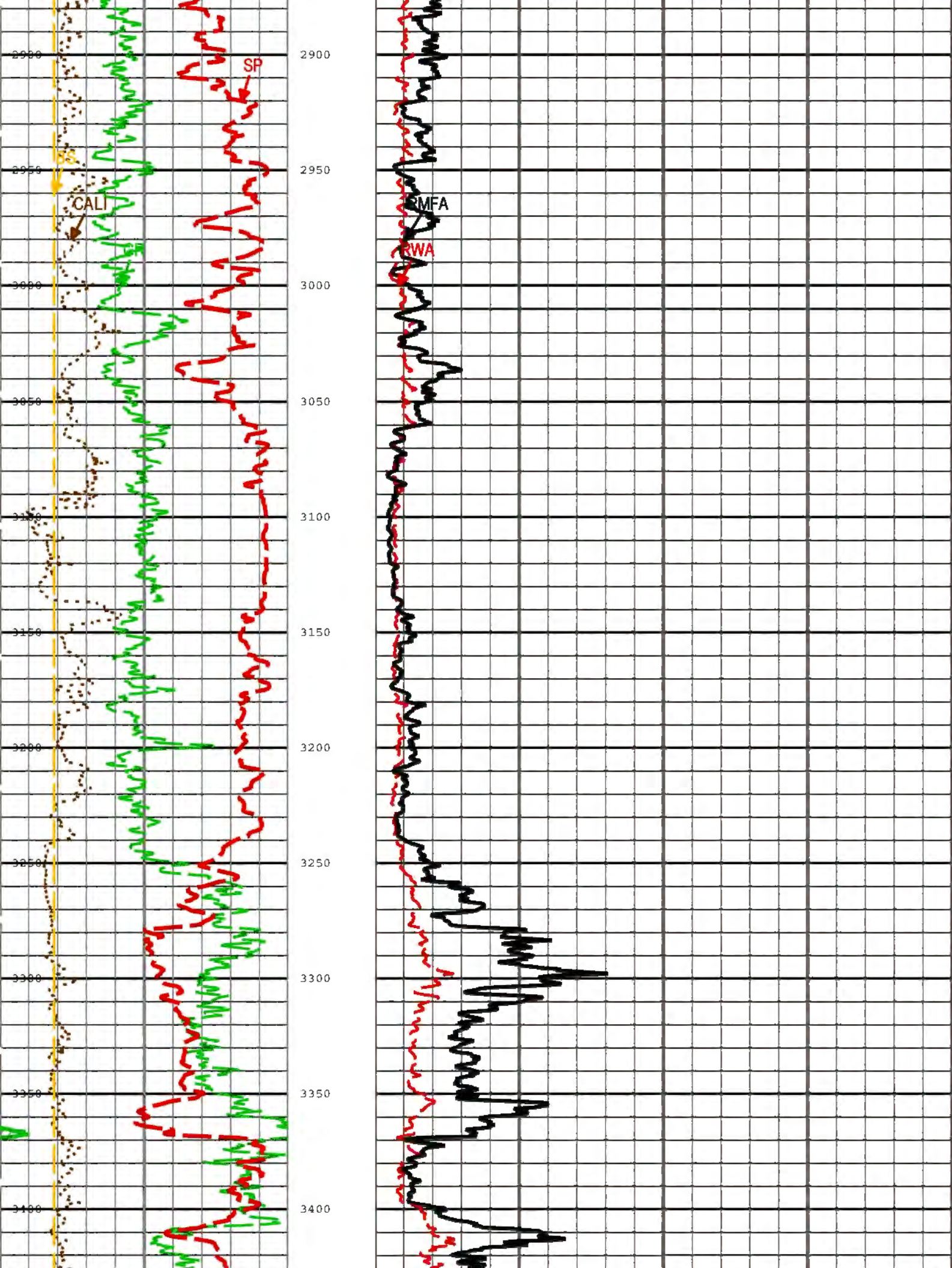
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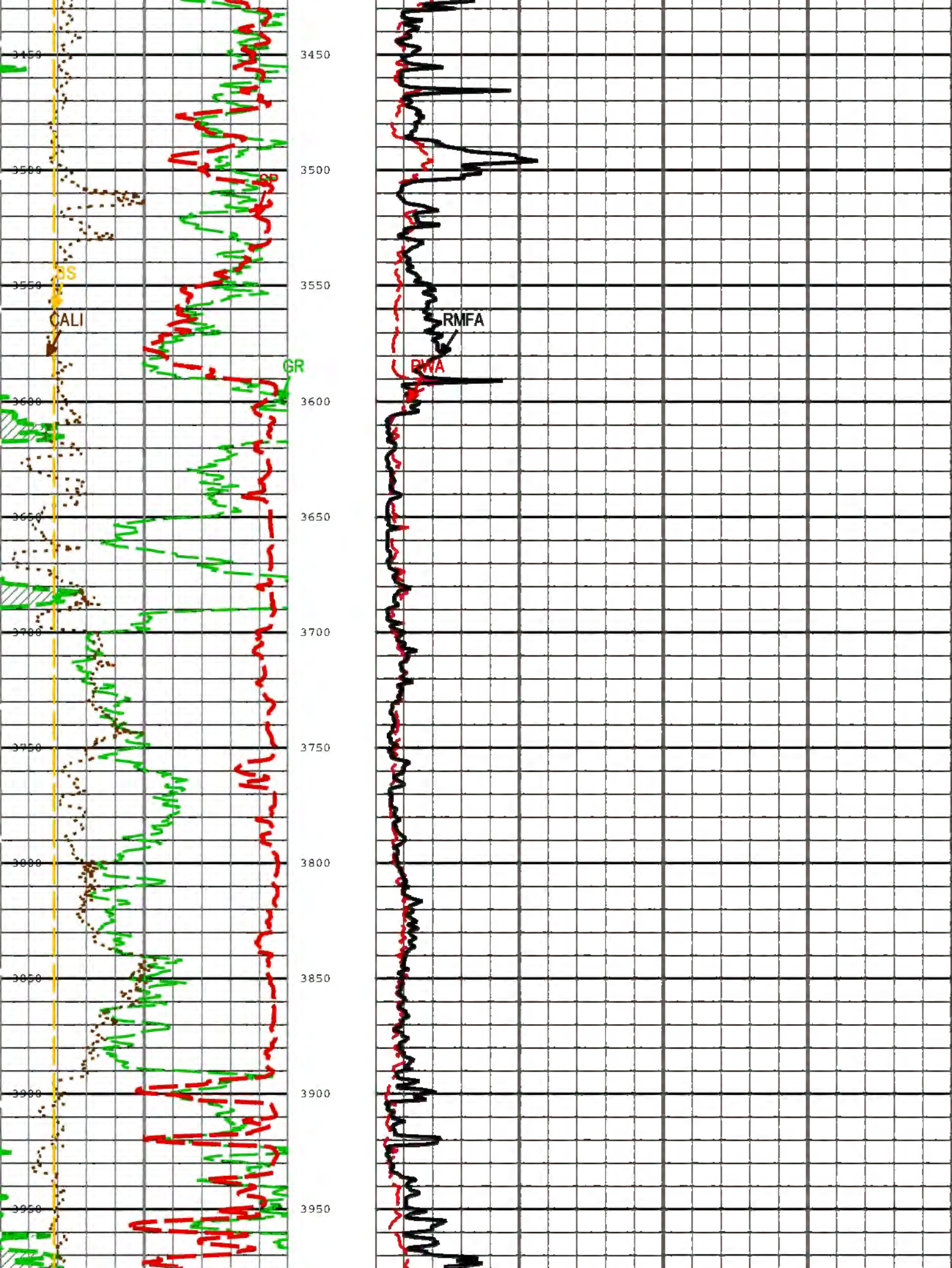
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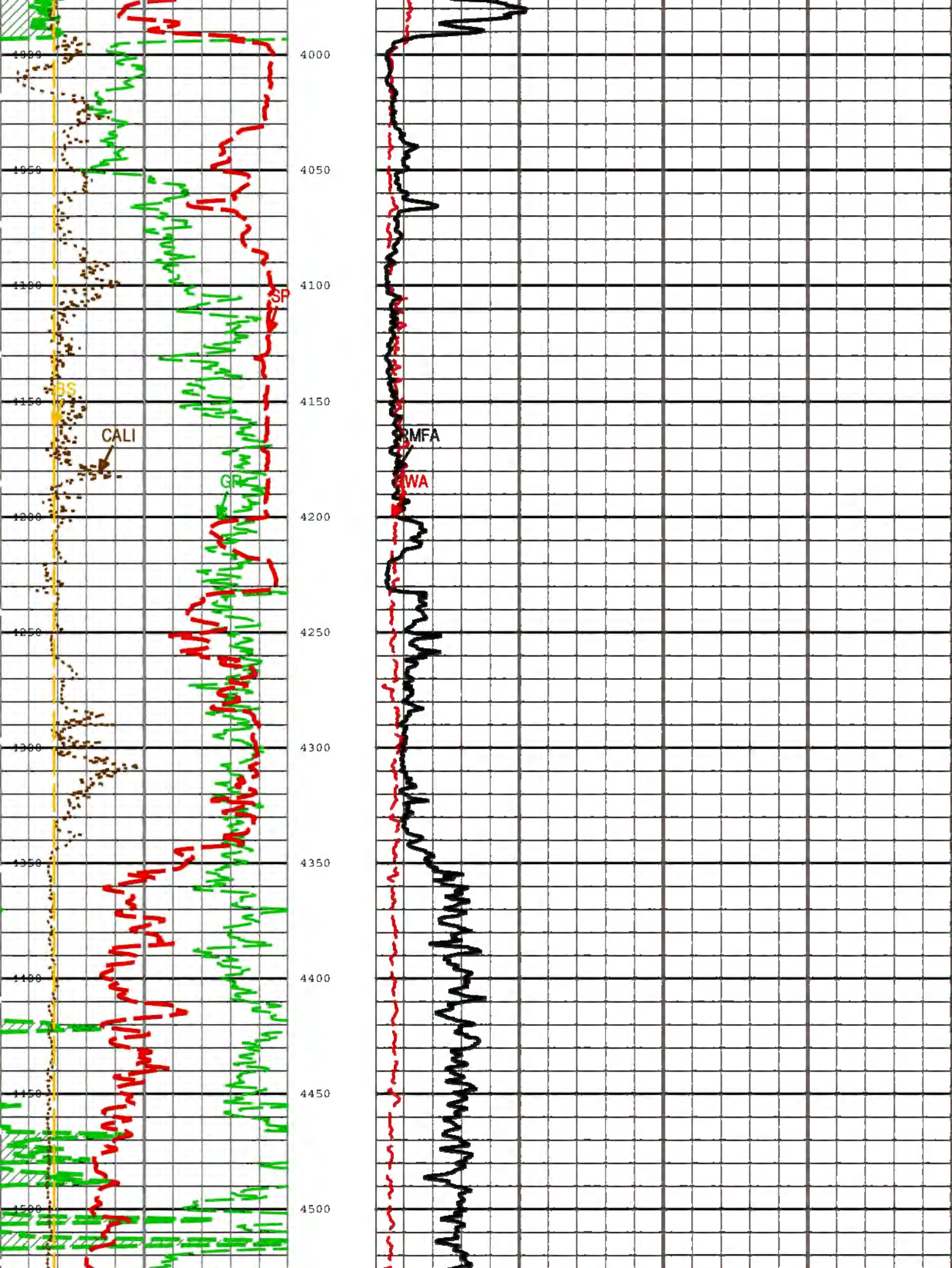
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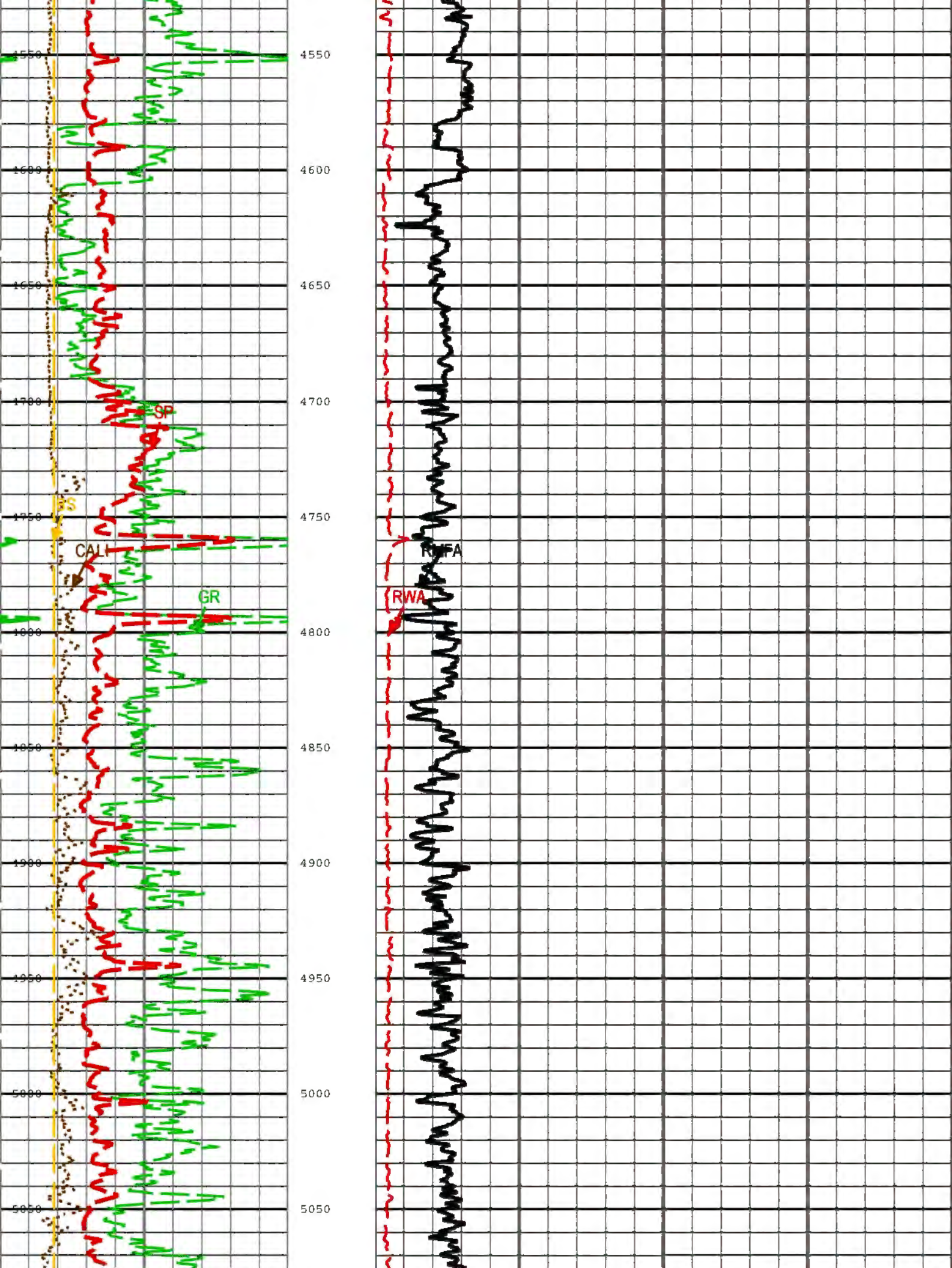
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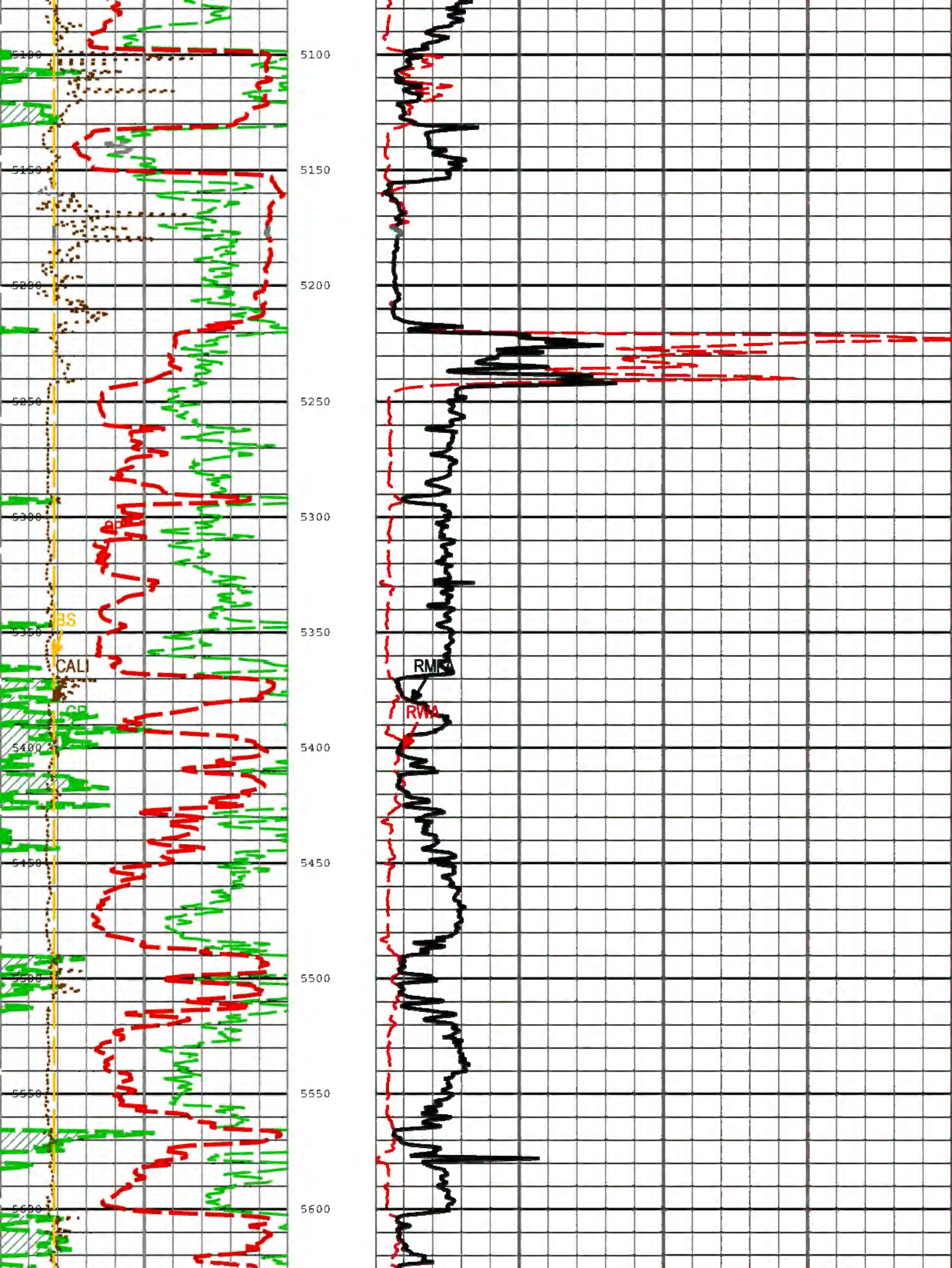
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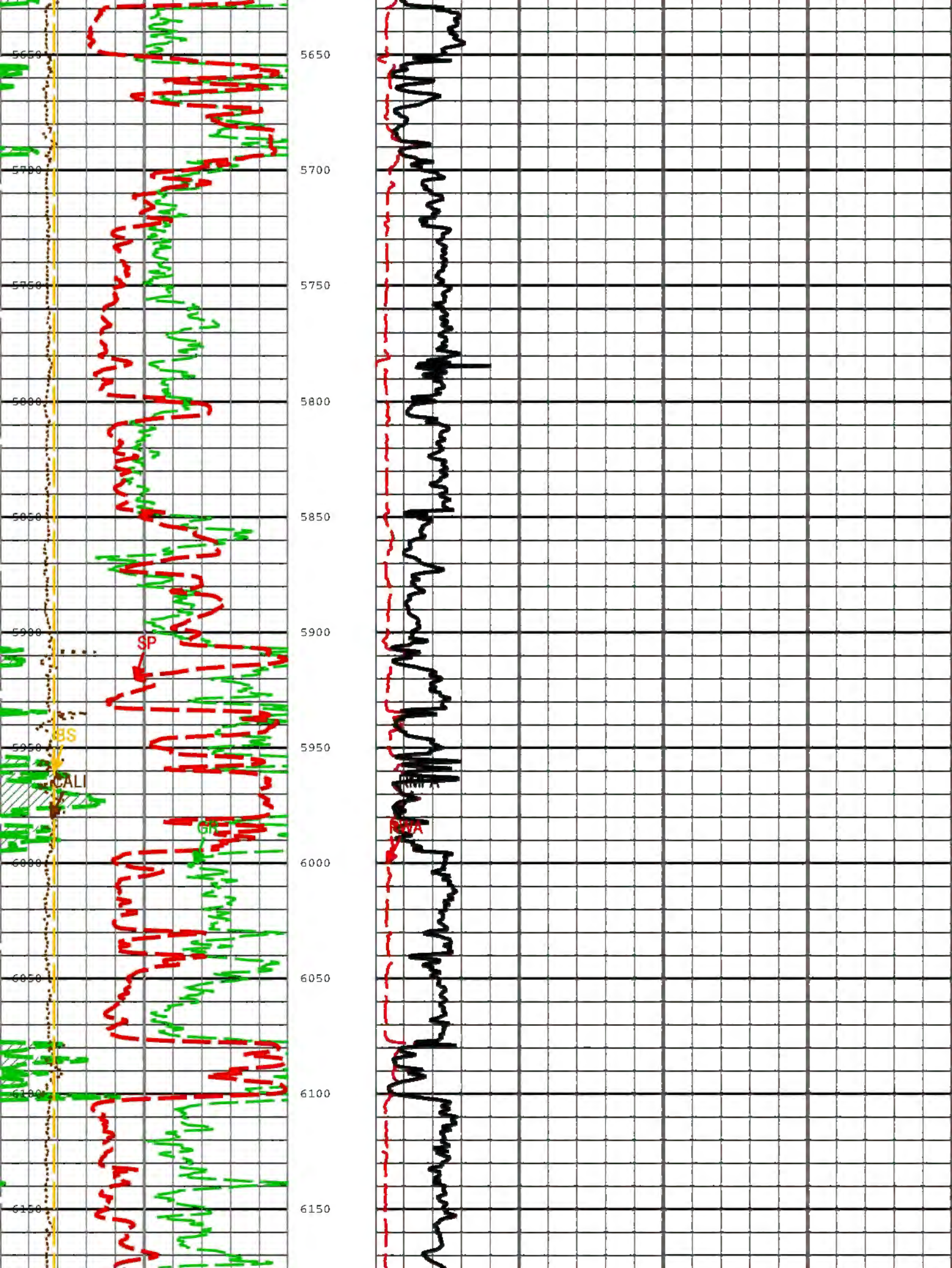
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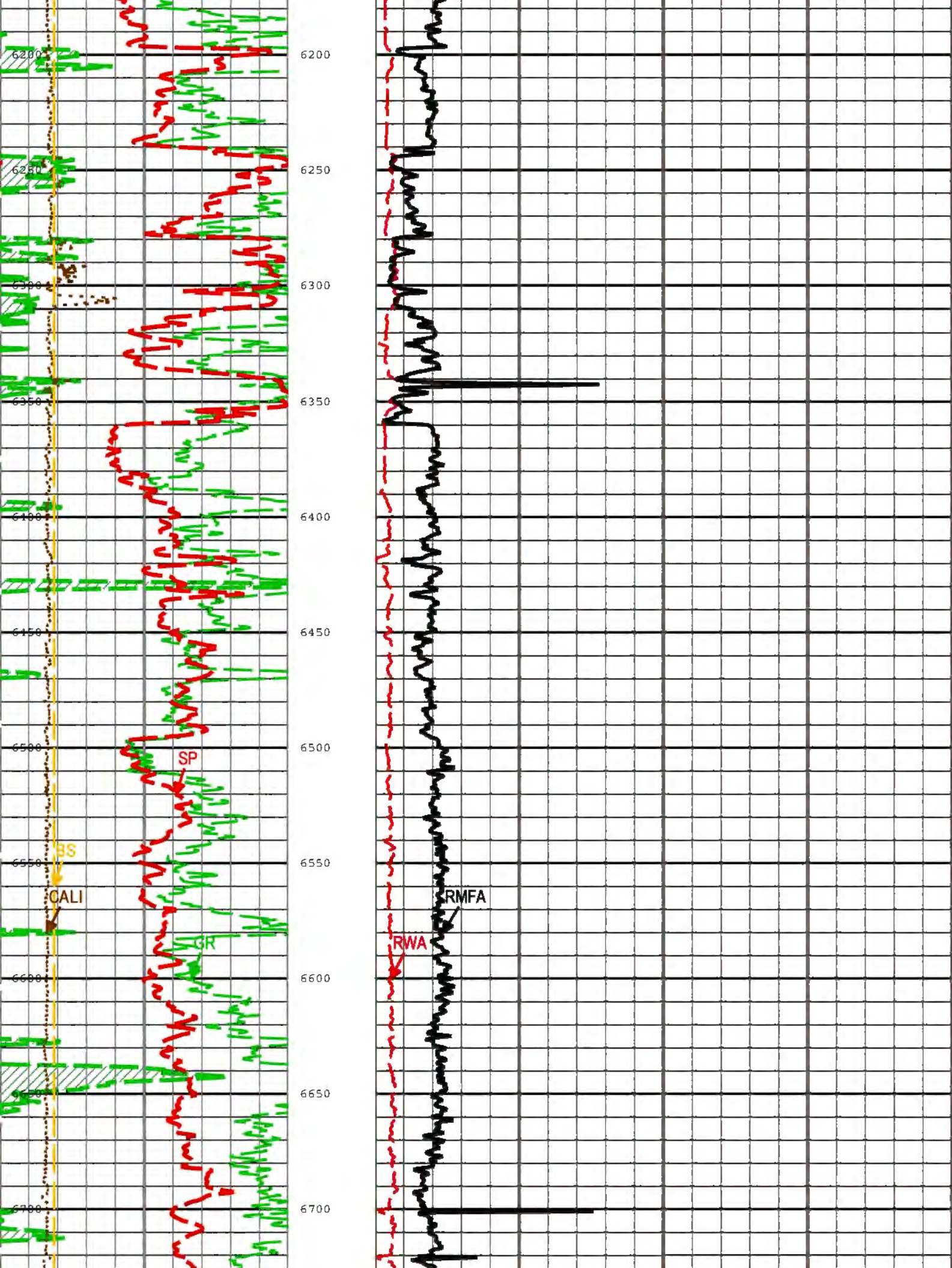
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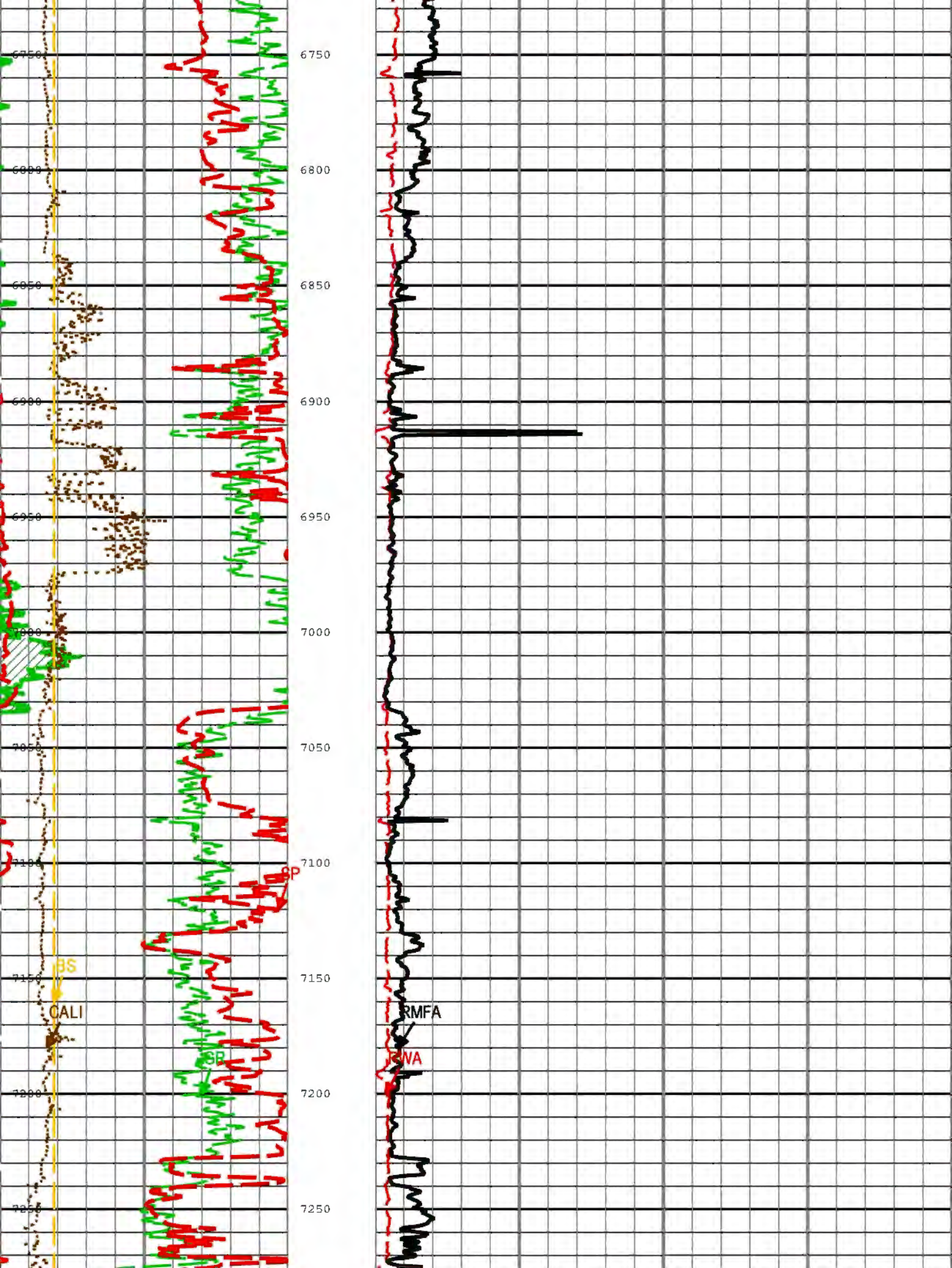
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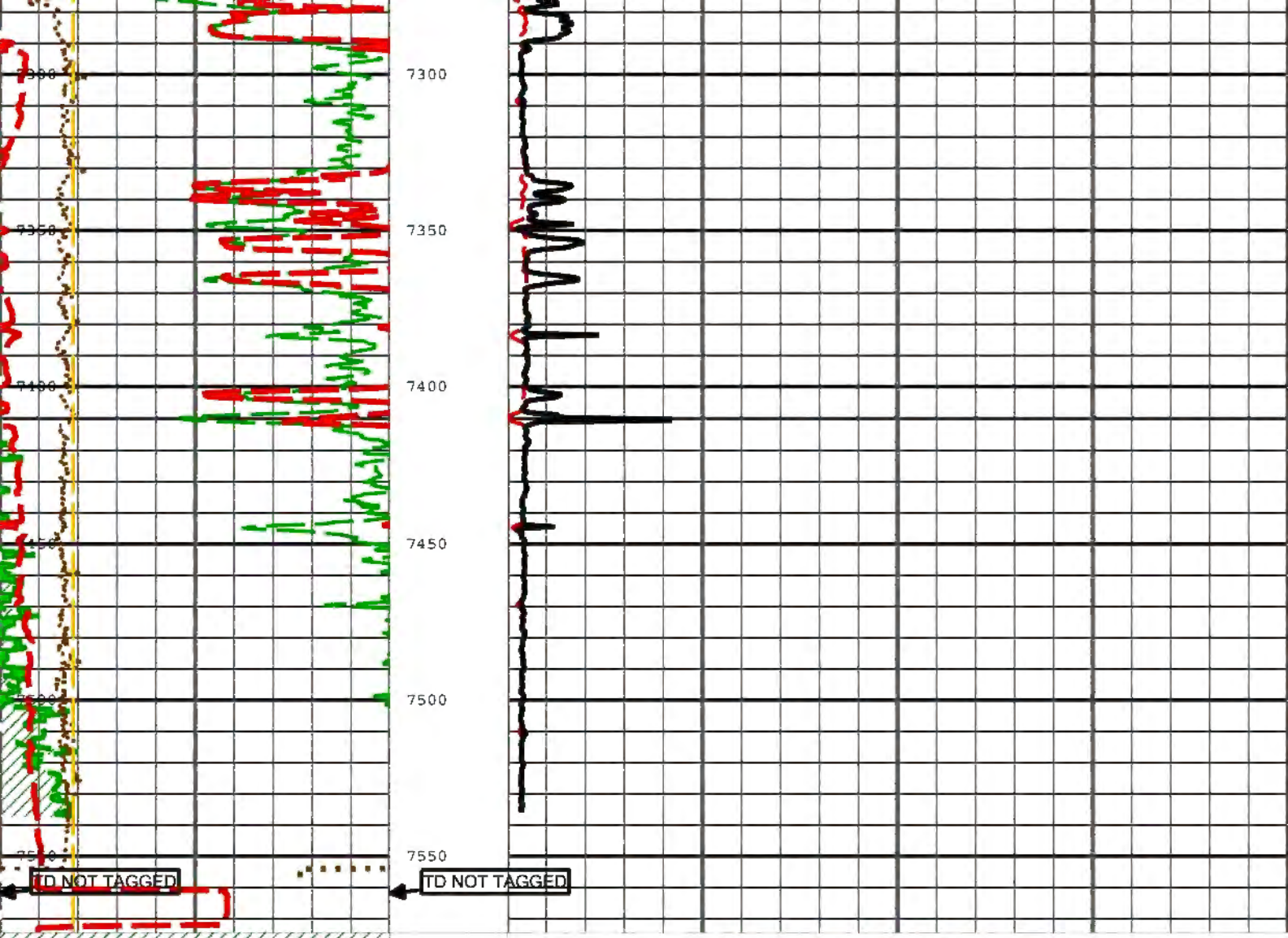


TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (Copy of 2 in) Index Scale: 2 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:29

Channel Processing Parameters

Parameter	Description	ToolPath	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-H:AHIS:AHIS	Compute Standoff	
ABLM	Array Induction Basic Logs Mode	AIT-H:AHIS:AHIS	Normal	
ACDE	Array Induction Casing Detection Enable	AIT-H:AHIS:AHIS	No	
BARI	Barite Mud Presence Flag	Borehole	No	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	COMPLETION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	320	ppm

CALI_SHIFT	CALI Supplementary Offset	HDRS-B:HRCC-B:HRCC-B	0.157	in
CBLO	Casing Bottom (Logger)	COMPLETION	516	ft
CDEN	Cement Density	HGNS-B:HGNS-B:HGNS-B	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.2	lbm/gal
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	BS	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
M	Exponent M of the Archie Formation Factor - Porosity Equation	Borehole	2	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
N	N Exponent in SW Formula	Borehole	2	
RW	Connate Water Resistivity	Borehole	1	ohm.m
SP_SHIFT	SP Shift	AIT-H:AHIS:AHIS	-30	mV
SPDR	SP Drift Per Foot	AIT-H:AHIS:AHIS	0	mV/ft
TWS	Connate Water Temperature	Borehole	68	degF

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	0	480	516
BS	7.875	516	7574.5

All depth are actual.

Tool Control Parameters

Parameter	Description	ToolPath	Value	Unit
HMCA_BRD_TYPE	HMCA Board Type	HGNS-B:HGNS-B:HMCA-B	0	

One

Main Pass 5" = 100 ft

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit
ICV	Integrated Cement Volume	GCSE_UP_PASS, FCD	1607.84	ft3
IHV	Integrated Hole Volume	GCSE_UP_PASS	2387.33	ft3

Software Version

Acquisition System	Version
MaxWell	3.0.9609.0
Application Patch	SP-20110816-3.0.9609.1150

Computation	Description	Version
Borehole	Borehole Ensemble provides common Borehole Parameters and Channels	3.0.9609.0
HENVIR	Computation Ensemble for the HGNS Neutron environmental corrections	3.0.9609.0
PEQL	Platform Express Quicklook	3.0.9609.0

SoftwareVersion_Tool	SoftwareVersion_Run Version	SoftwareVersion_Build Version
WAFE-SEC	Synergy SV451EC version 8.10	Synergy SV451EC version 9.10
WAFE-FEC	Synergy SV451EC version 8.10	Synergy SV451EC version 9.10
WAFE-TMDI	Synergy SV451EC version 35.19	Synergy SV451EC version 36.19

Tool Elements	Description	Software Version	Firmware Version
HMCA-B	HILT Master Communication Assembly, 125 degC	3.0.9609.0	3.0
HRGD-B	HILT Resistivity Gamma-Ray Density Device, 125 degC	3.0.9609.0	3.0
AHIS	Array Induction Sonde - H	3.0.9609.1150	
HGNS-B	HILT Gamma-Ray and Neutron Sonde, 125 degC	3.0.9609.0	2.0
HRCC-B	HILT High-Resolution Control Cartridge, 125 degC	3.0.9609.0	2.0

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift
One	Log[3]:Up	Up	366.35 ft	7574.85 ft	20-Dec-2011 6:53:20 PM	20-Dec-2011 9:07:14 PM	14.58 ft

All depths are referenced to toolstring zero

Log

One: Log[3]:Up 4CA9F5AE-D314-4D61-B9EA-FBFF6559E5F2

Description: HGNS standard resolution porosities for Platform Express Format: Log (5 in) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured D
Date: 21-Dec-2011 04:14:35

Channel	Source	Sampling
AT10	AIT-H:AHIS:AHIS	3in
AT20	AIT-H:AHIS:AHIS	3in
AT30	AIT-H:AHIS:AHIS	3in
AT60	AIT-H:AHIS:AHIS	3in
AT90	AIT-H:AHIS:AHIS	3in
BS	Borehole	6in
CALI	HDRS-B:HRCC-B:HRCC-B	1in
CTEM	HGNS-B:HGNS-B:HMCA-B	6in
GR	HGNS-B:HGNS-B:HGNS-B	6in
HDRA	HDRS-B:HRMS-B:HRGD-B	2in
ICV	Borehole	6in
IHV	Borehole	6in
RHOZ	HDRS-B:HRMS-B:HRGD-B	2in
RWA	PEQL	6in
RXOZ	HDRS-B:HRMS-B:HRGD-B	2in
SMIN	HDRS-B:HRMS-B:HRGD-B	2in
SMNO	HDRS-B:HRMS-B:HRGD-B	2in
SP	AIT-H:AHIS:AHIS	6in
TENS	WLWorkflow	1in
TIME_1900	WLWorkflow	0.1in
TNPH	HGNS-B:HGNS-B:HGNS-B	6in

ICV - Integrated Cement Volume every 100.00 (ft3)

IHV - Integrated Hole Volume every 100.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

IHV - Integrated Hole Volume every 10.00 (ft3)

ICV - Integrated Cement Volume every 10.00 (ft3)

Array Induction Two Foot Resistivity A10 (AT10) AIT-H

0.2 ohm.m 2000

Array Induction Two Foot Resistivity A20 (AT20) AIT-H

0.2 ohm.m 2000

Density Standoff Correction (HDRA) HDRS-B

-0.25 g/cm3 0.25

GR Backup

Caliper (CALI) HDRS-B

6 in 16

Perm Indicator

Array Induction Two Foot Resistivity A30 (AT30) AIT-H

0.2 ohm.m 2000

Crossover

Cable Tension (TENS)

10000 lbf 0

Bit Size (BS)

6 in 16

Synthetic Micro-Normal Resistivity (SMNO) HDRS-B

0 ohm.m 20

Array Induction Two Foot Resistivity A60 (AT60) AIT-H

0.2 ohm.m 2000

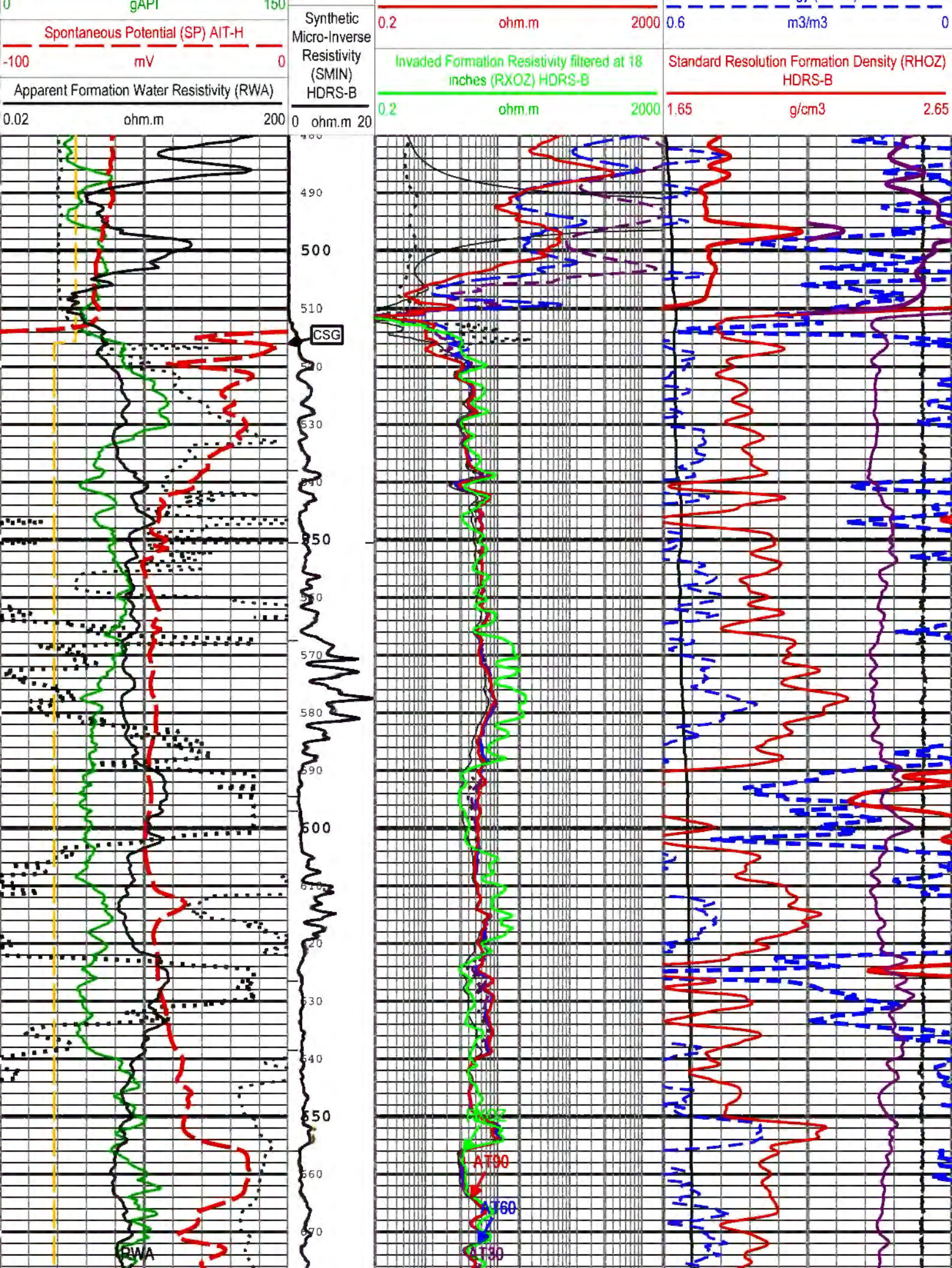
Cartridge Temperature (CTEM) HGNS-B

100 degF 200

Gamma Ray (GR) HGNS-B

Array Induction Two Foot Resistivity A90 (AT90) AIT-H

Thermal Neutron Porosity (Ratio Method) in Selected Lithology (TNPH) HGNS-B


0
gAPI
150
Spontaneous Potential (SP) AIT-H
-100
mV
0
Apparent Formation Water Resistivity (RWA)
0.02
ohm.m
200
Synthetic Micro-Inverse Resistivity (SMIN) HDRS-B
0
ohm.m
20
0.2
ohm.m
2000
Invaded Formation Resistivity filtered at 18 inches (RXOZ) HDRS-B
0.2
ohm.m
2000
0.6
m3/m3
0
Standard Resolution Formation Density (RHOZ) HDRS-B
1.65
g/cm3
2.65
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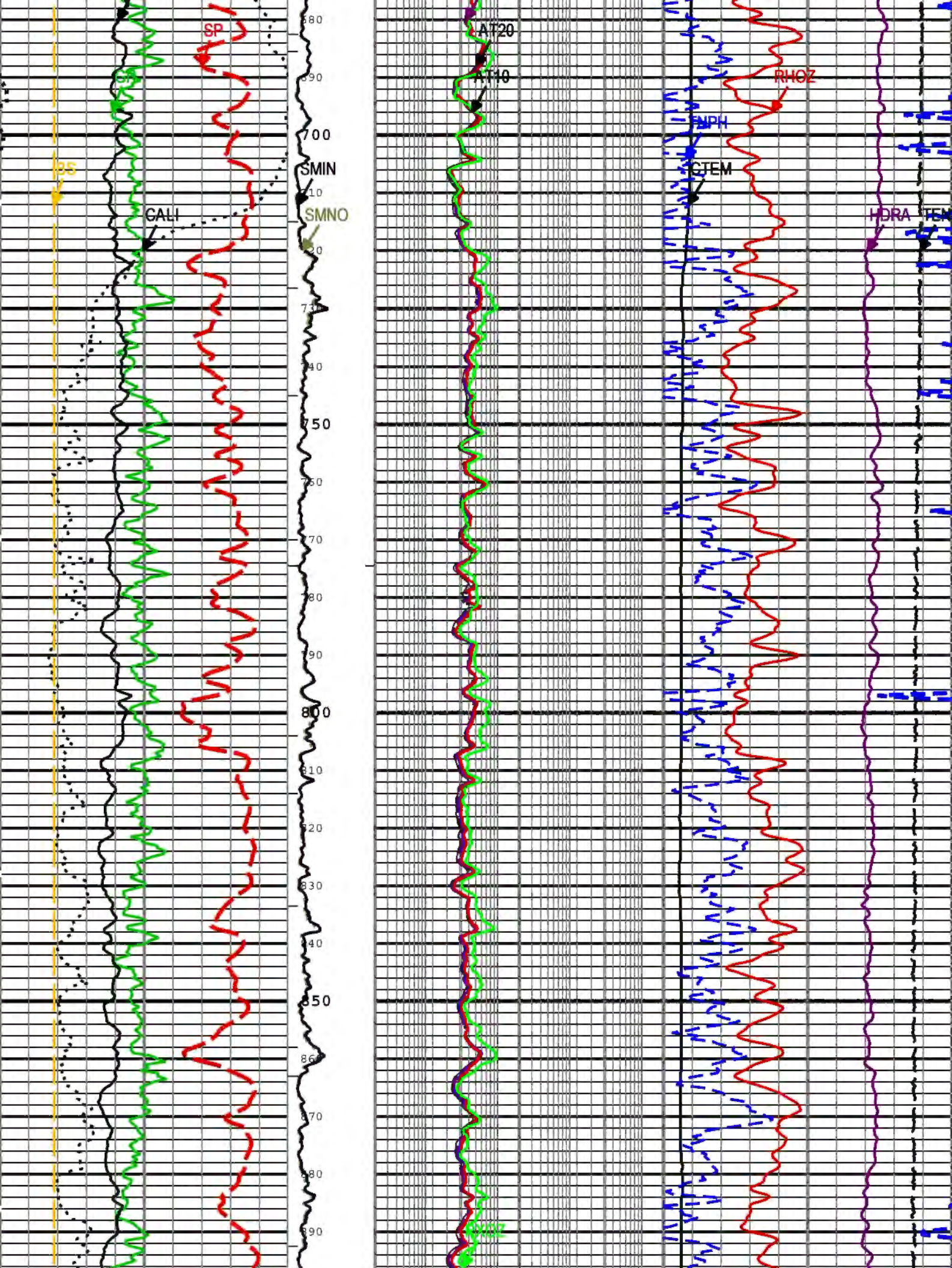
500
510
CSG
530
550
570
580
600
630
640
650
660
AT90
AT60
AT30
RWA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HDRA
TEN
700
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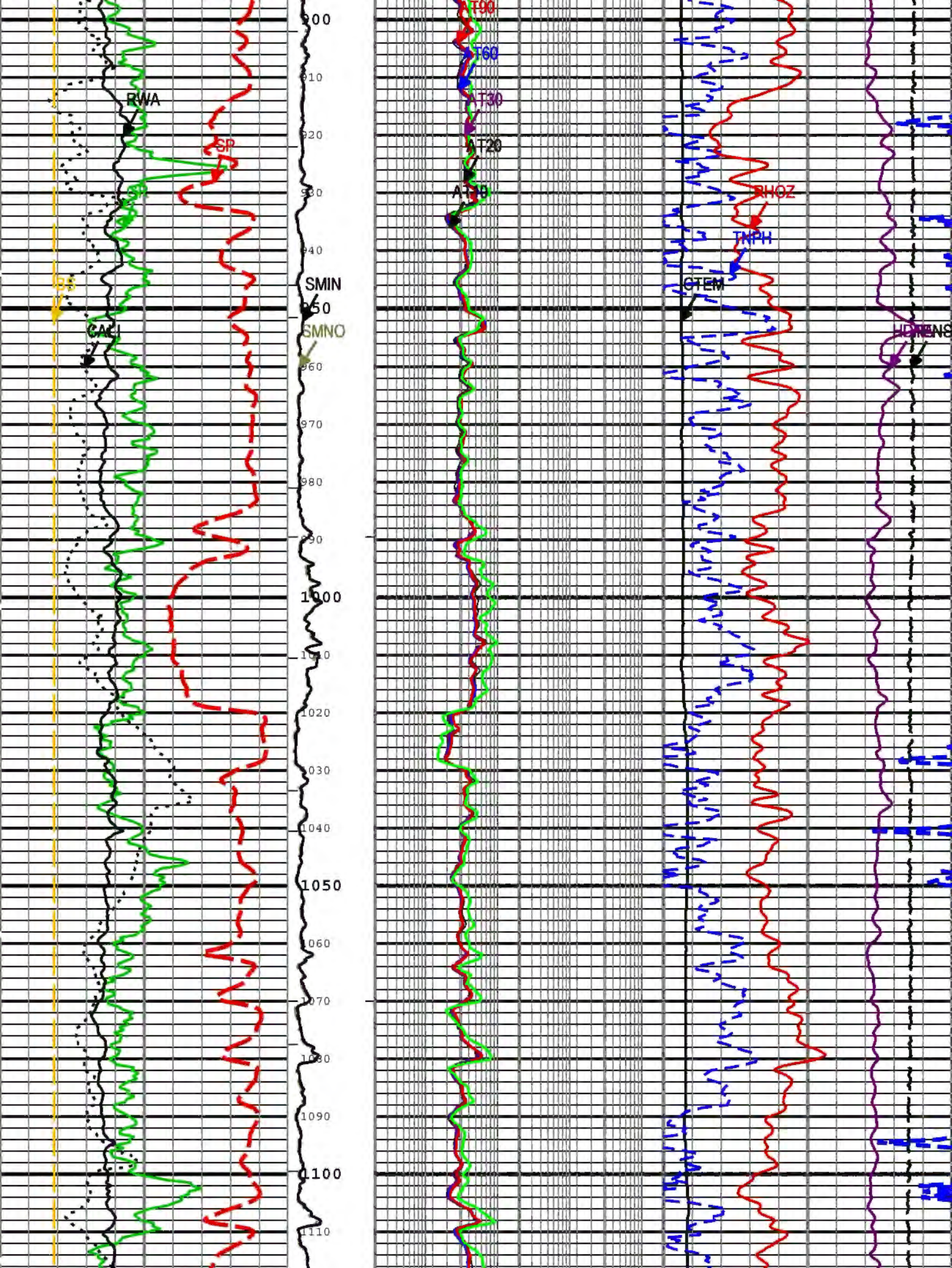
800
850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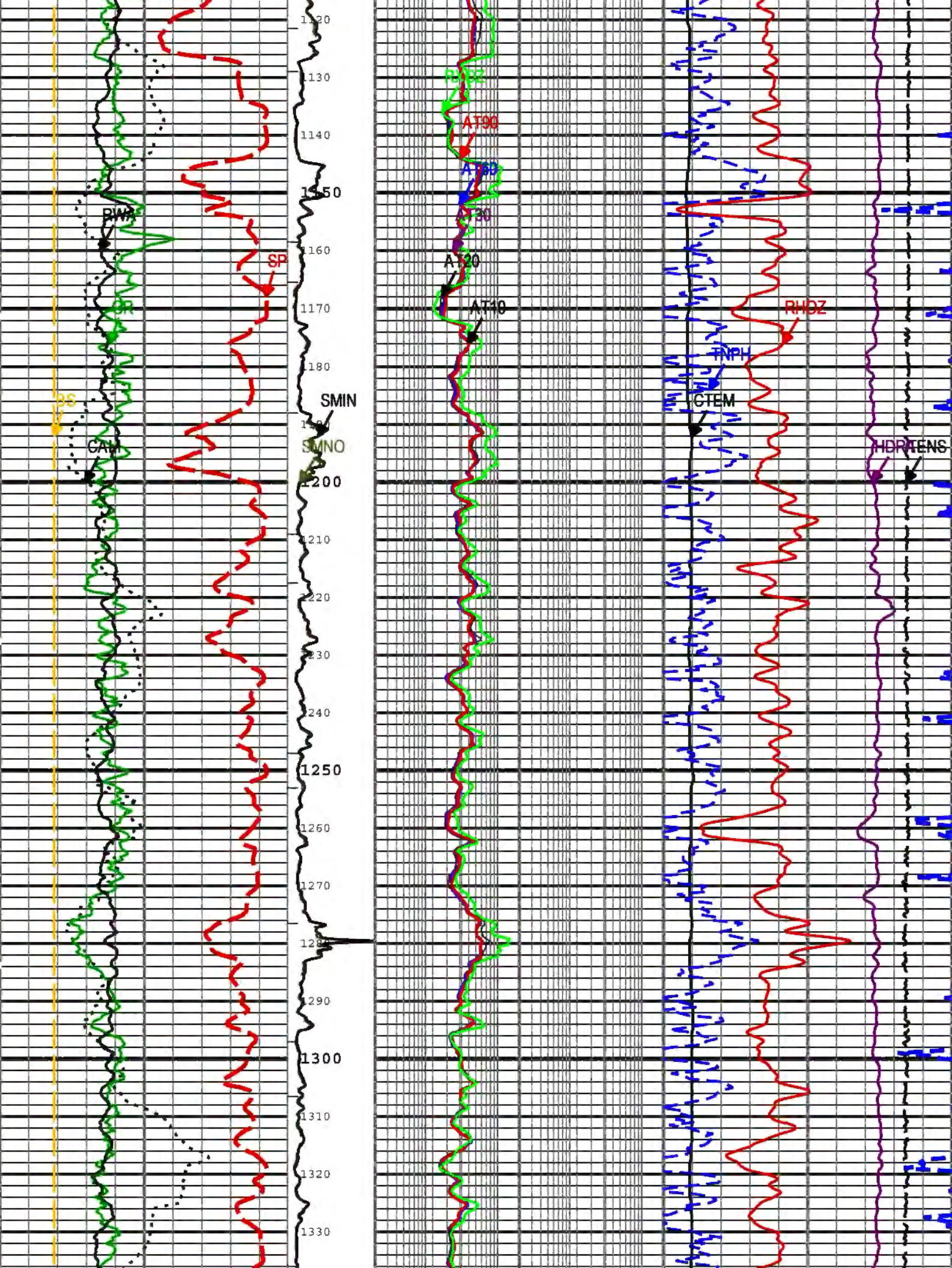

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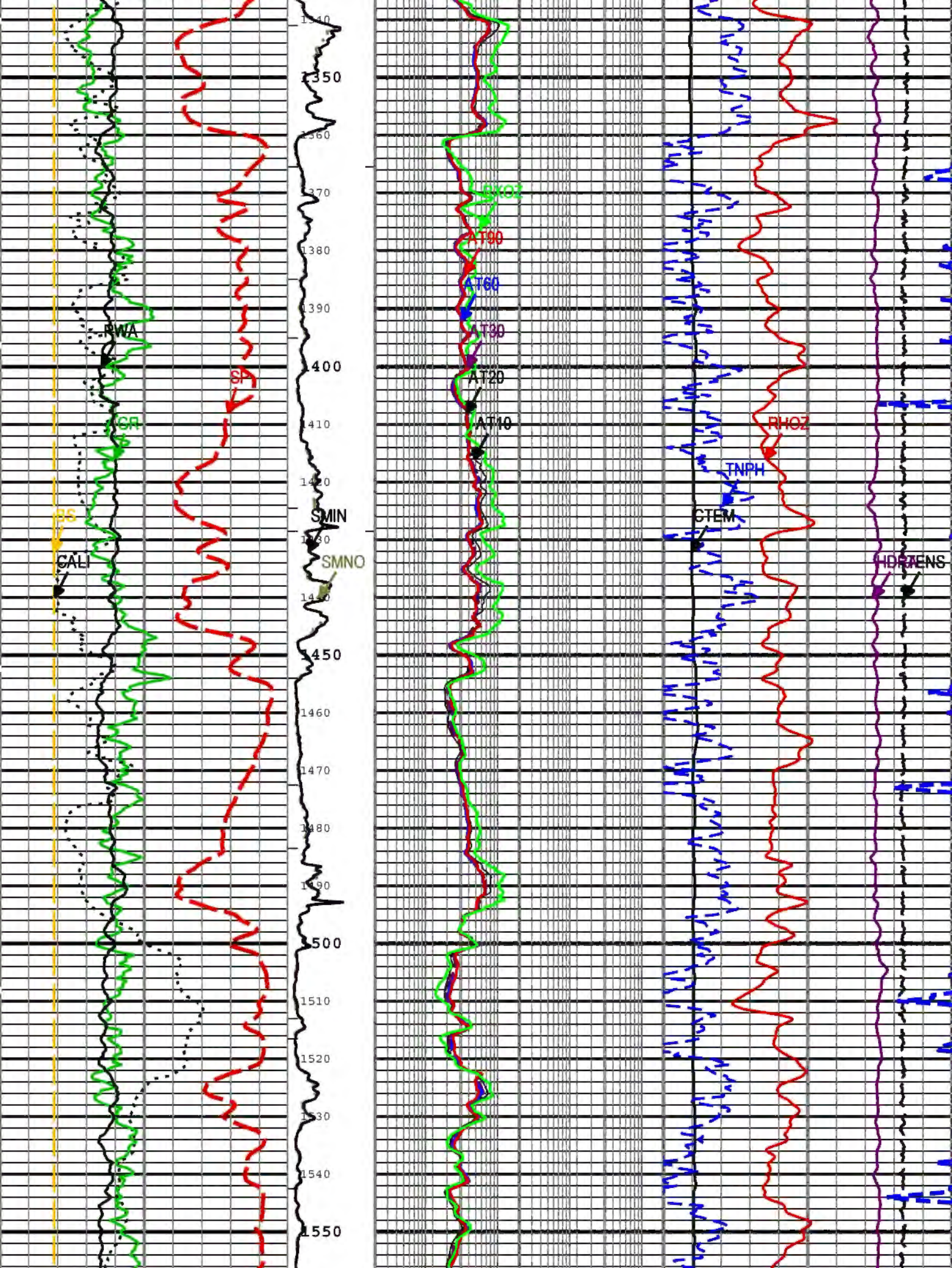
TENS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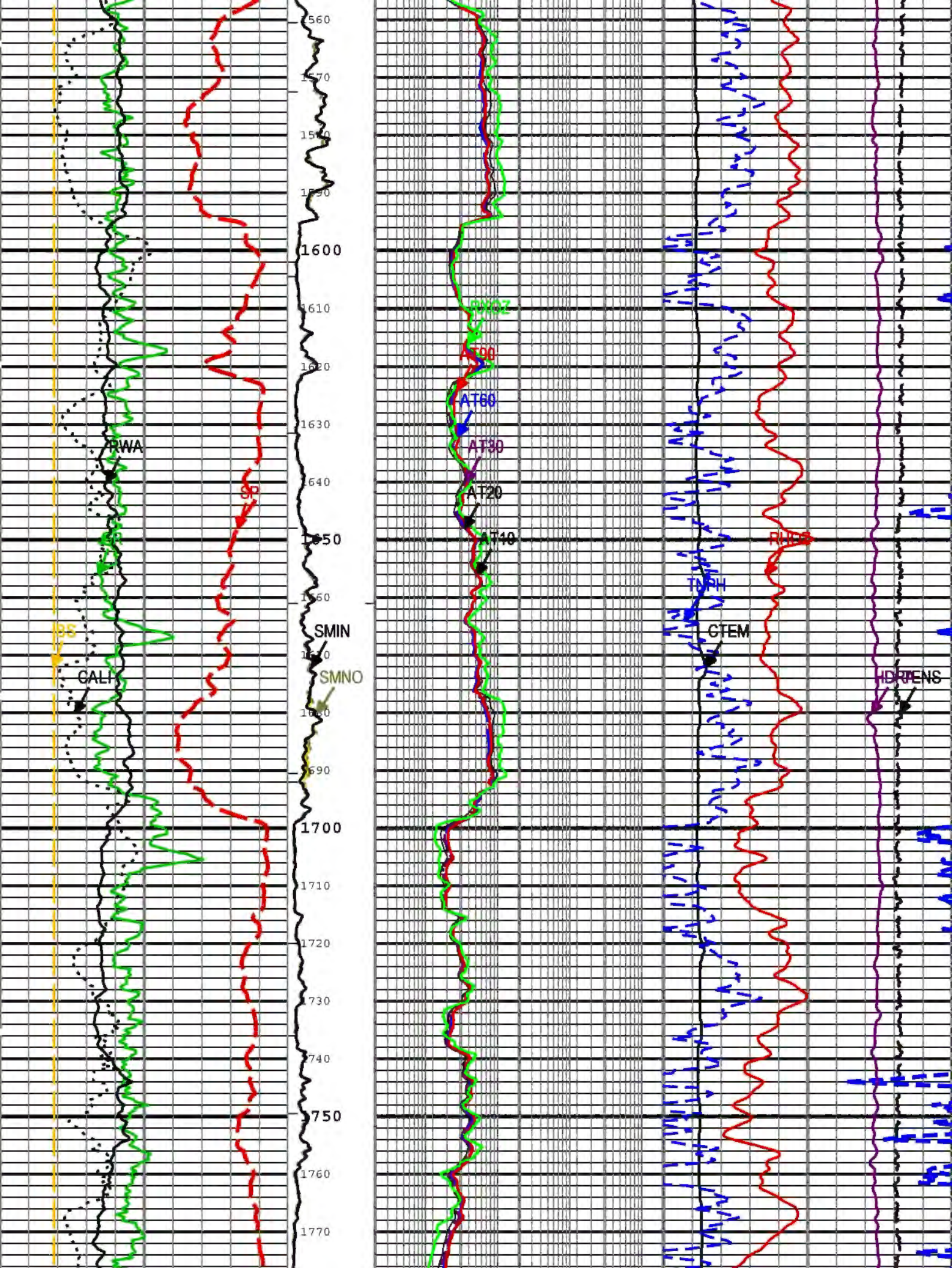

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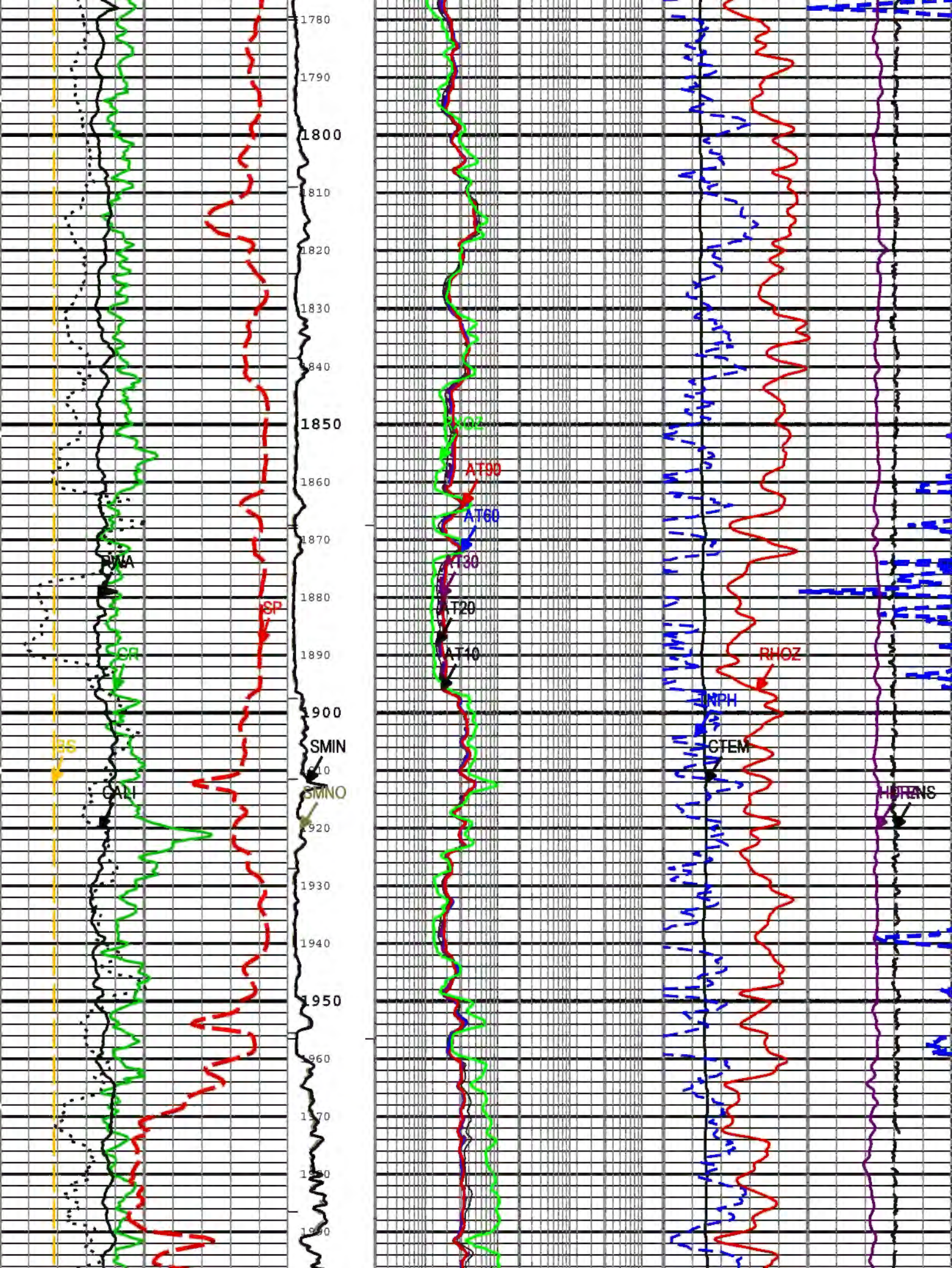
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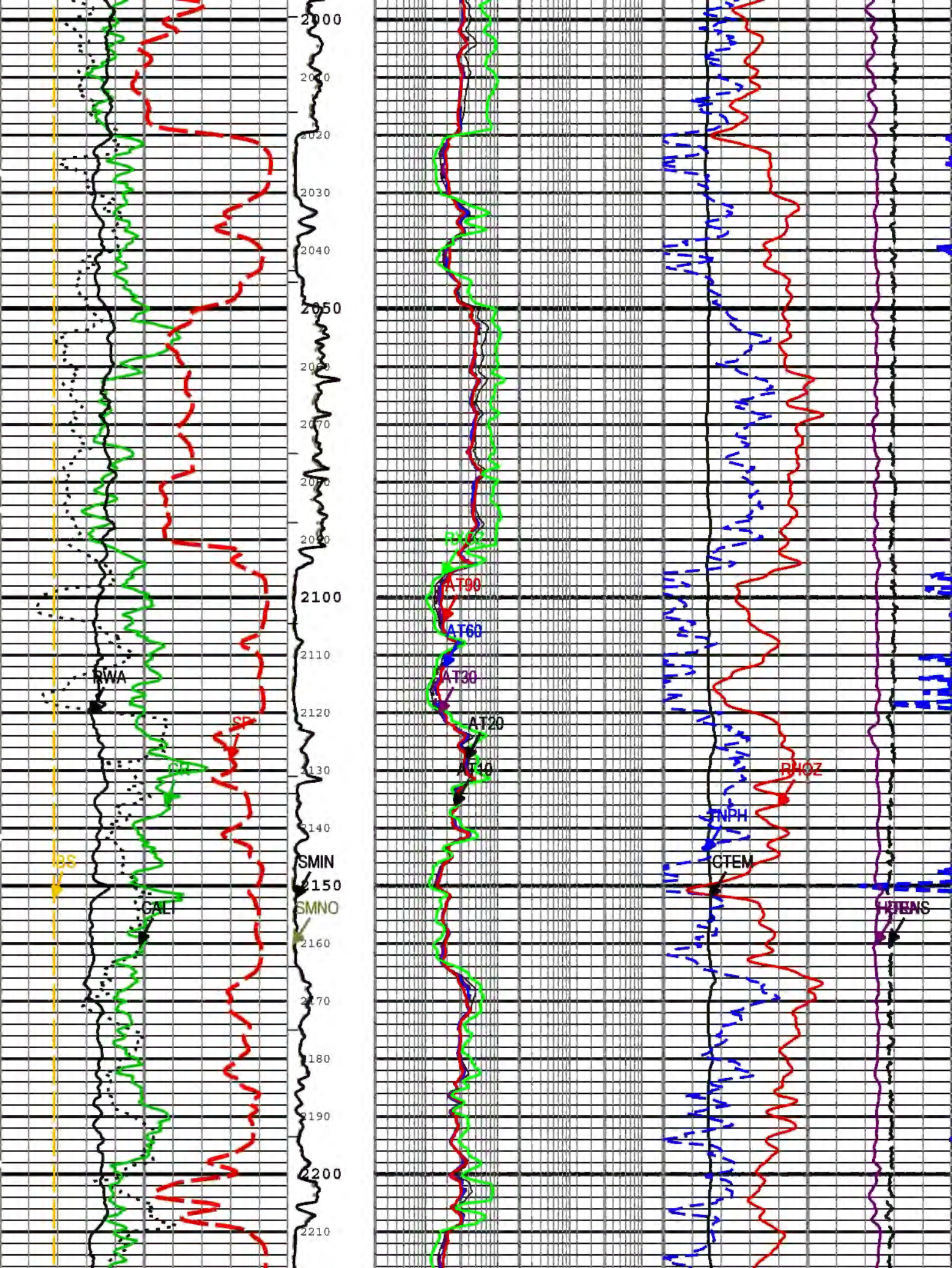
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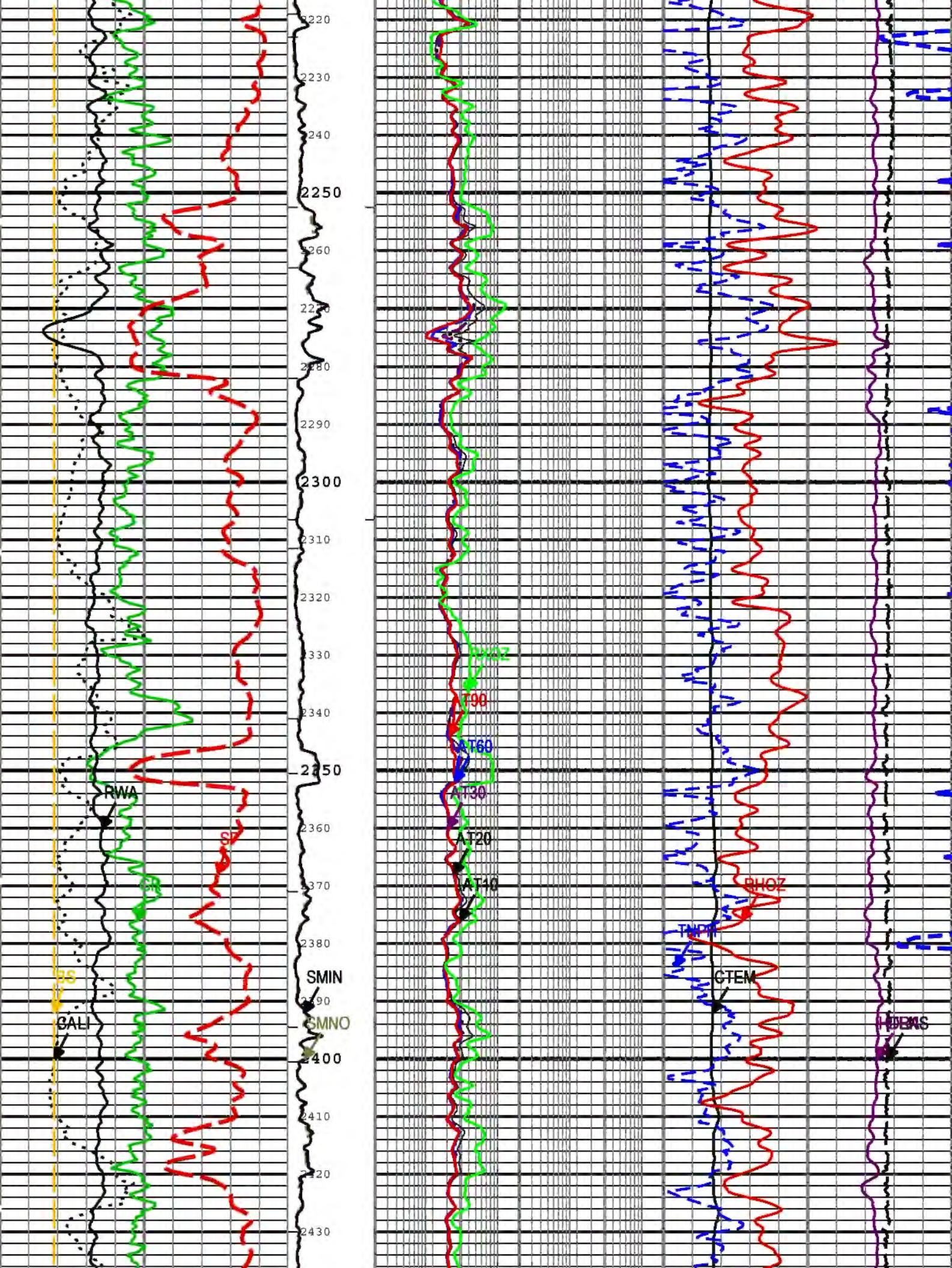
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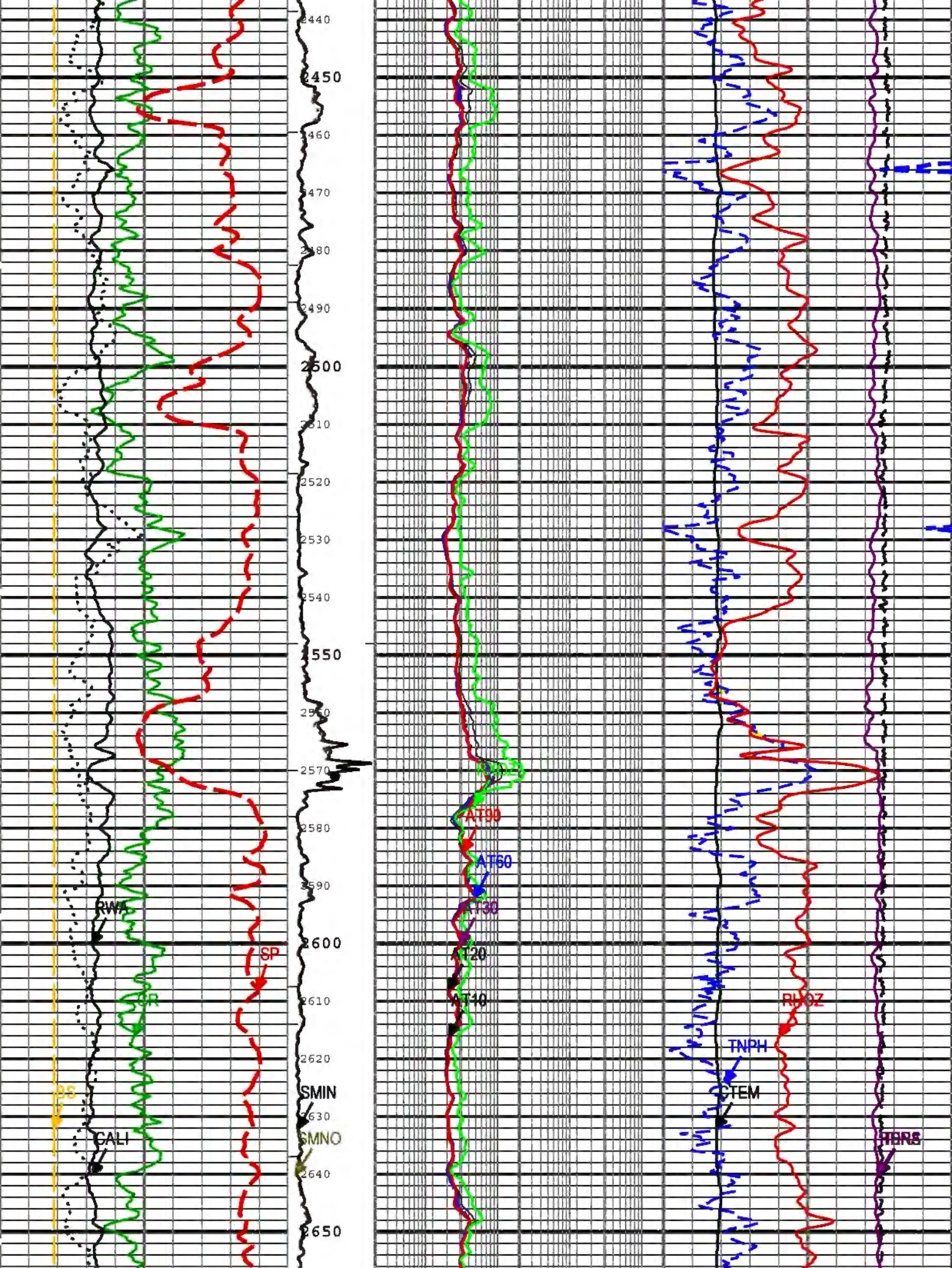
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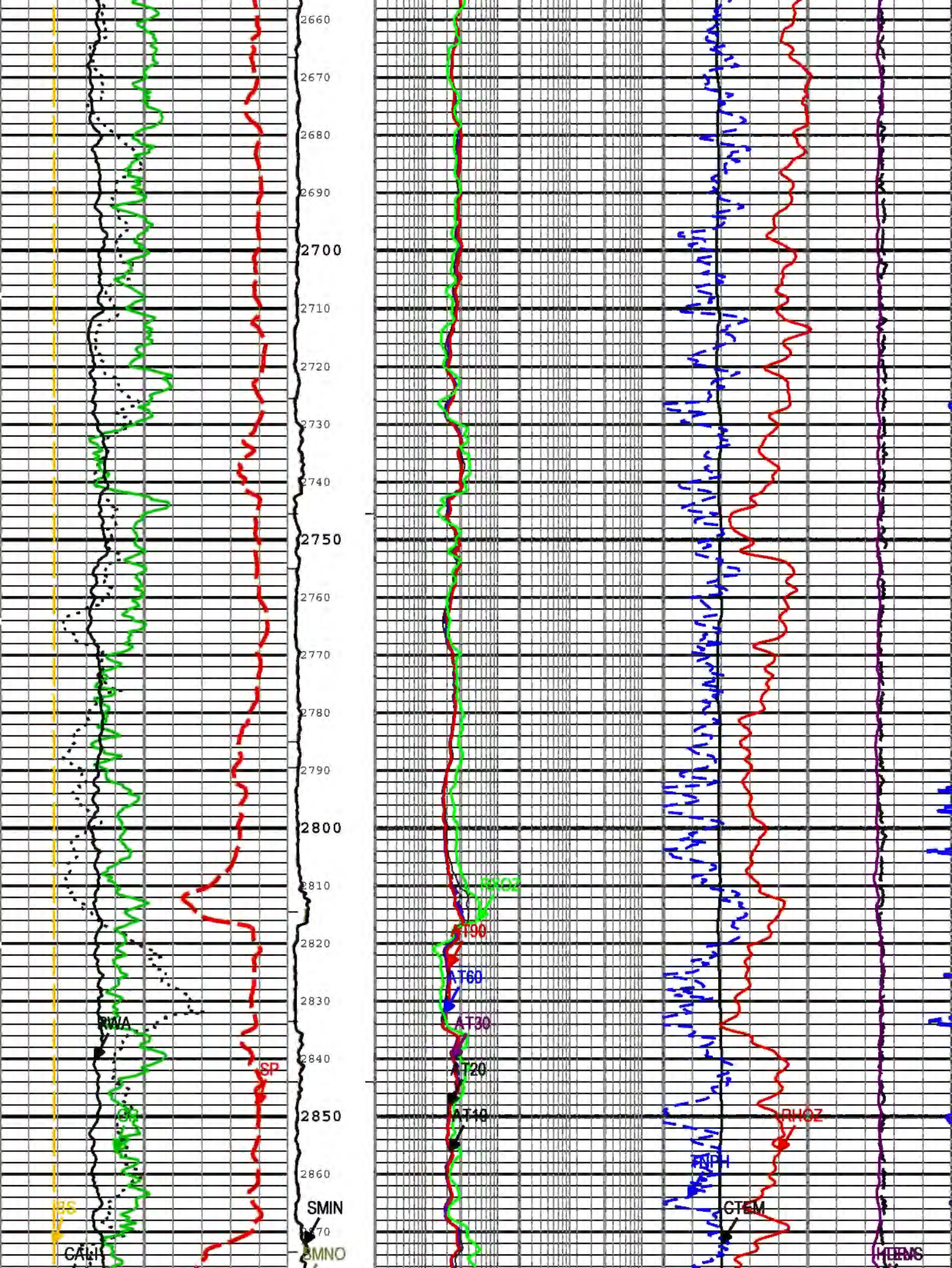
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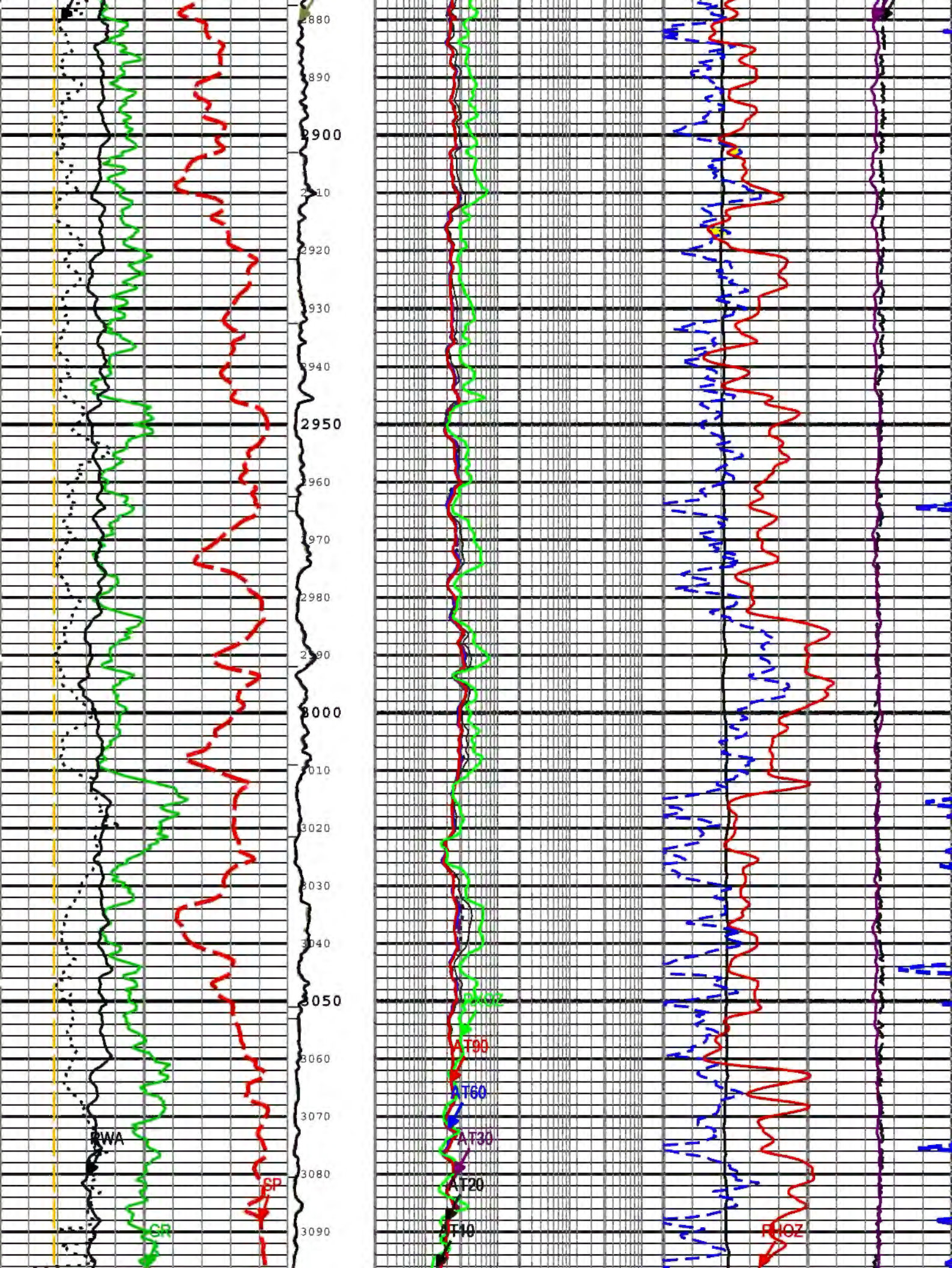
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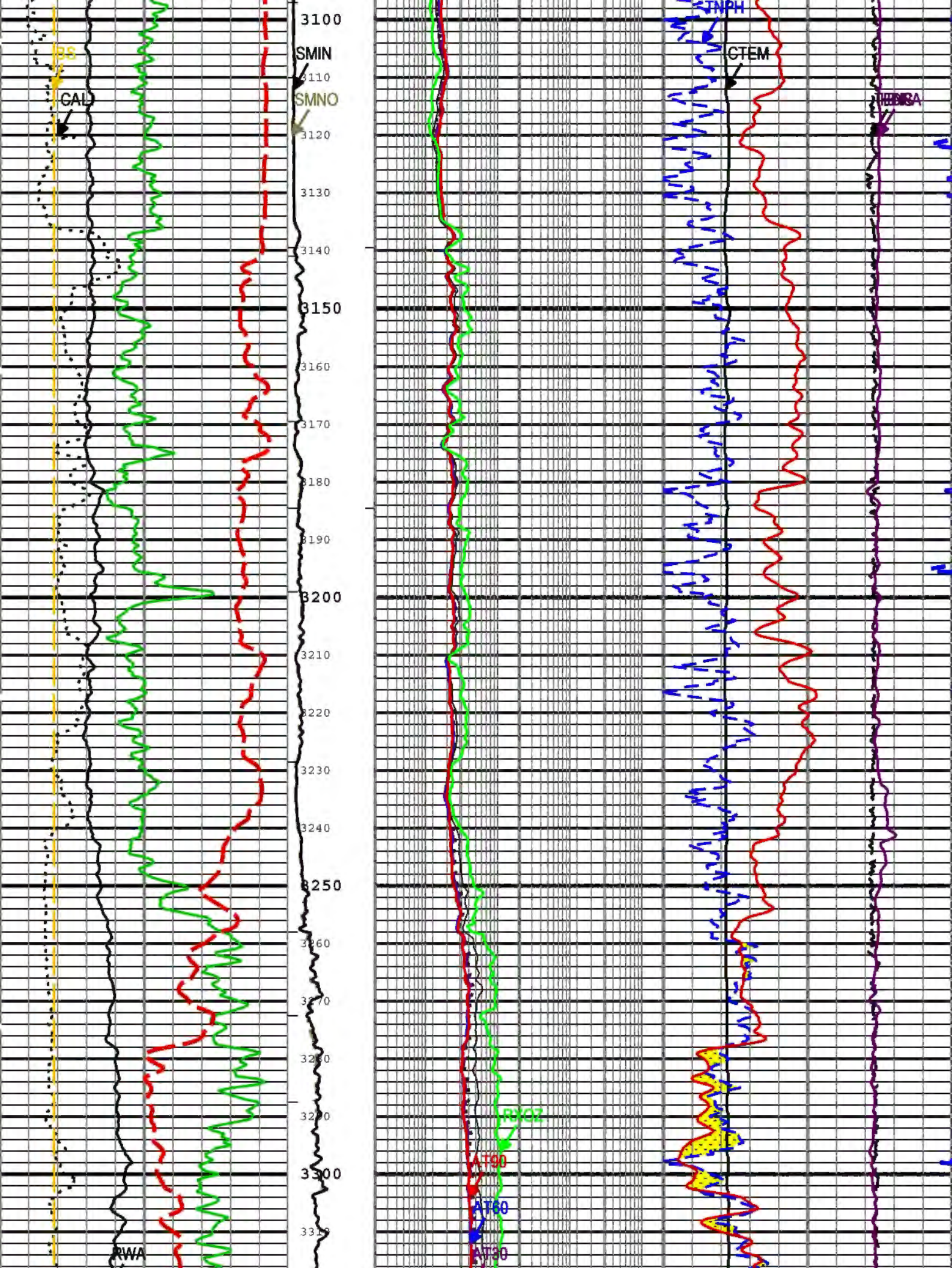
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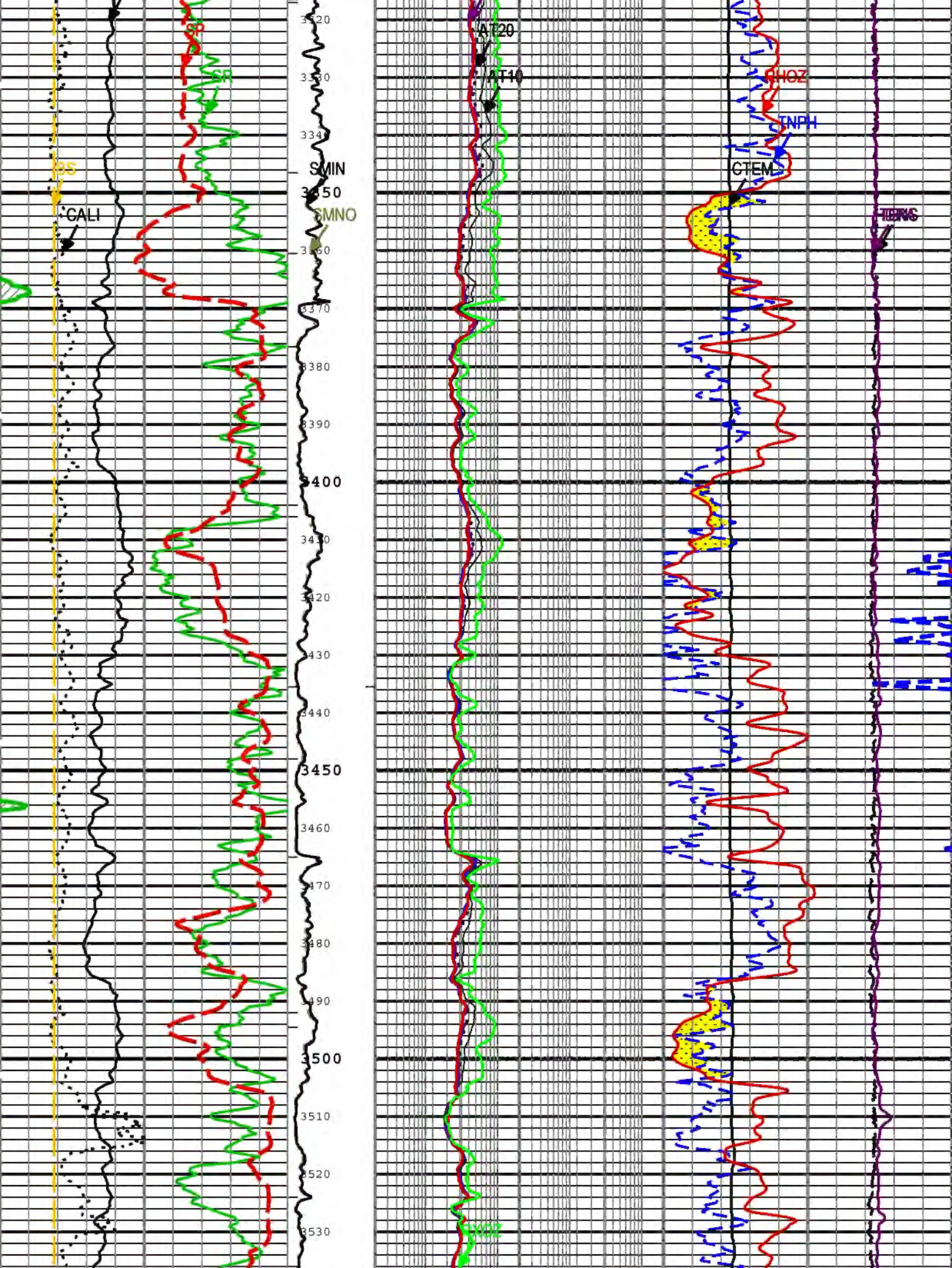

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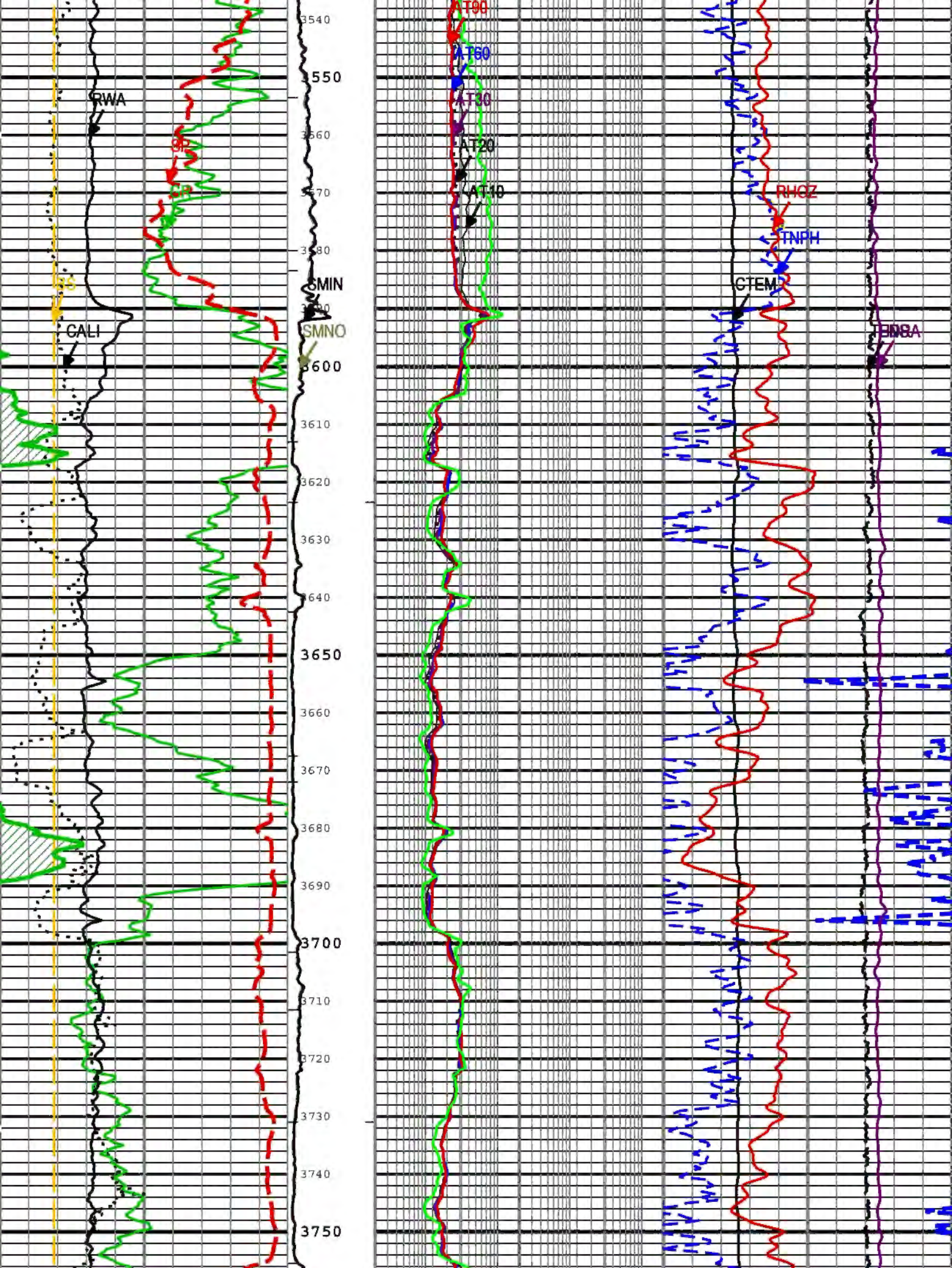
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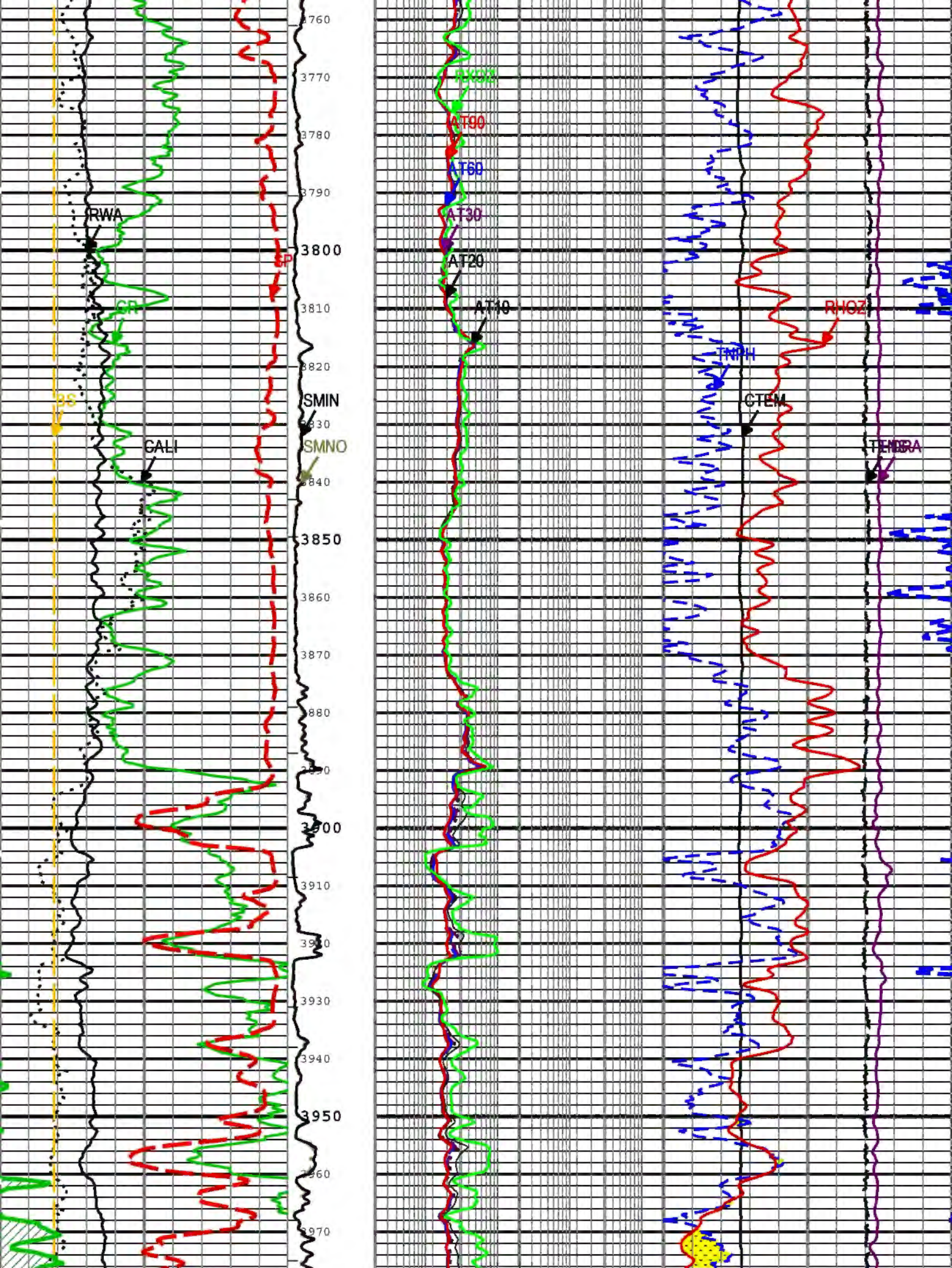
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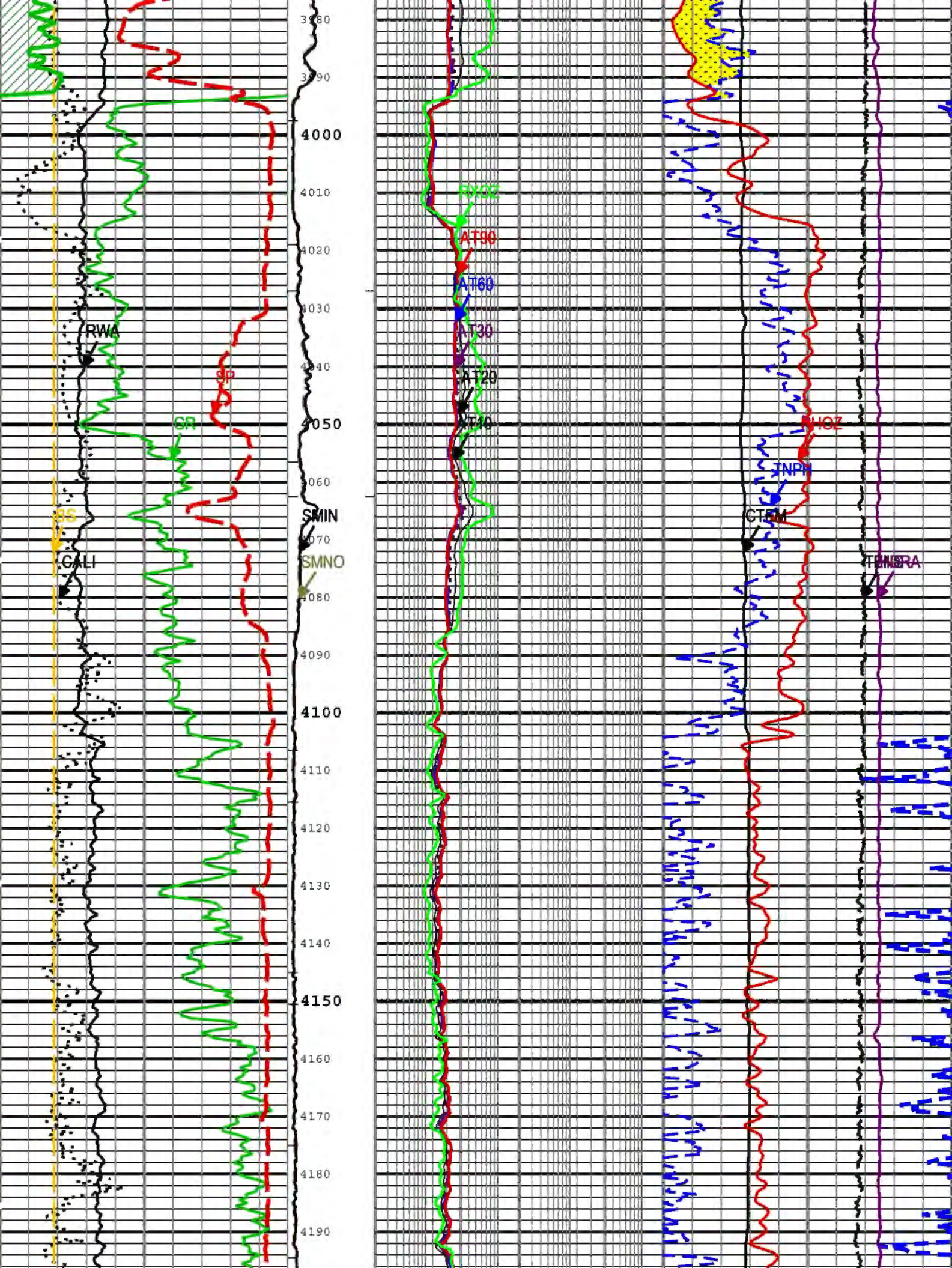
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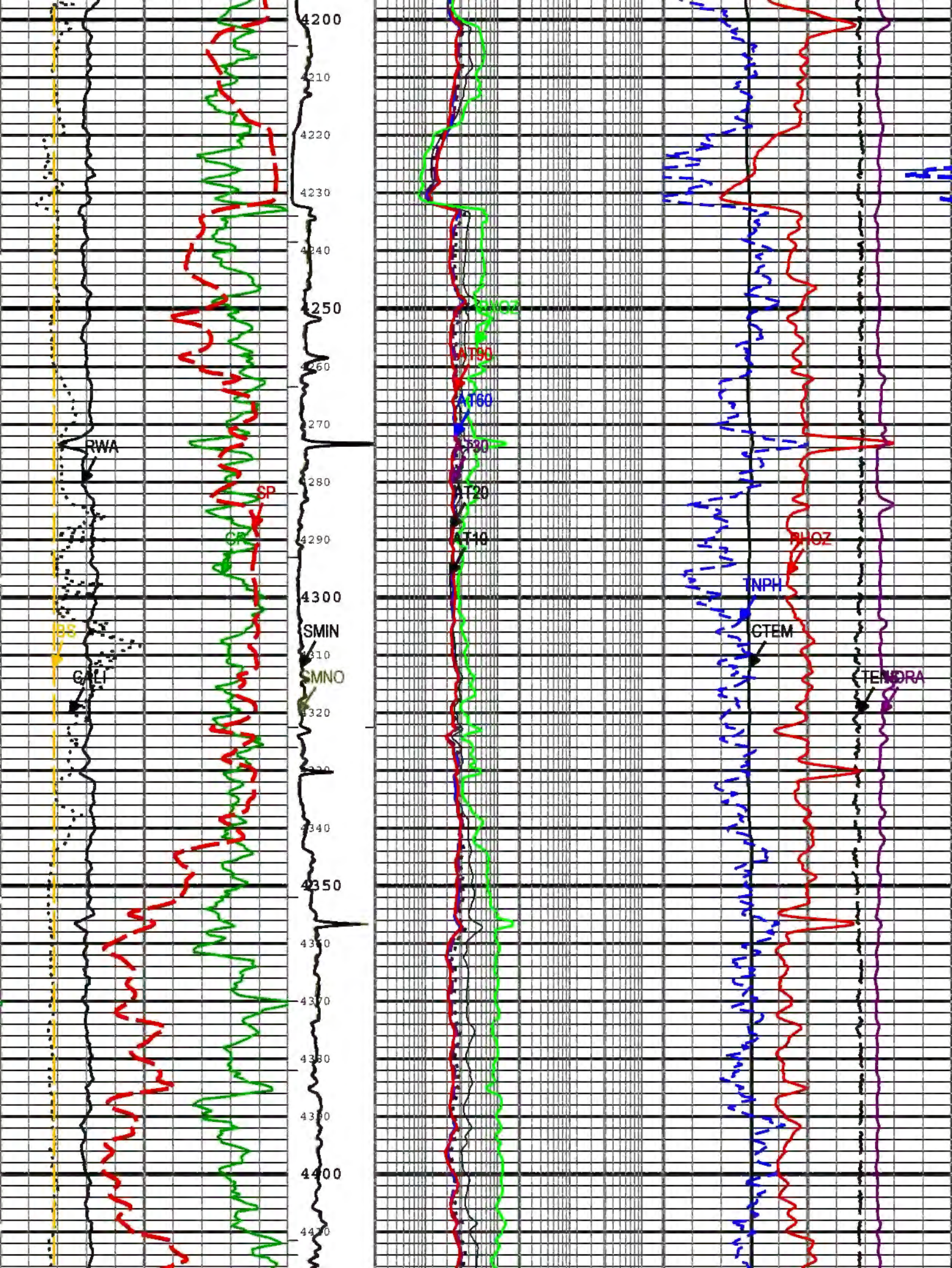
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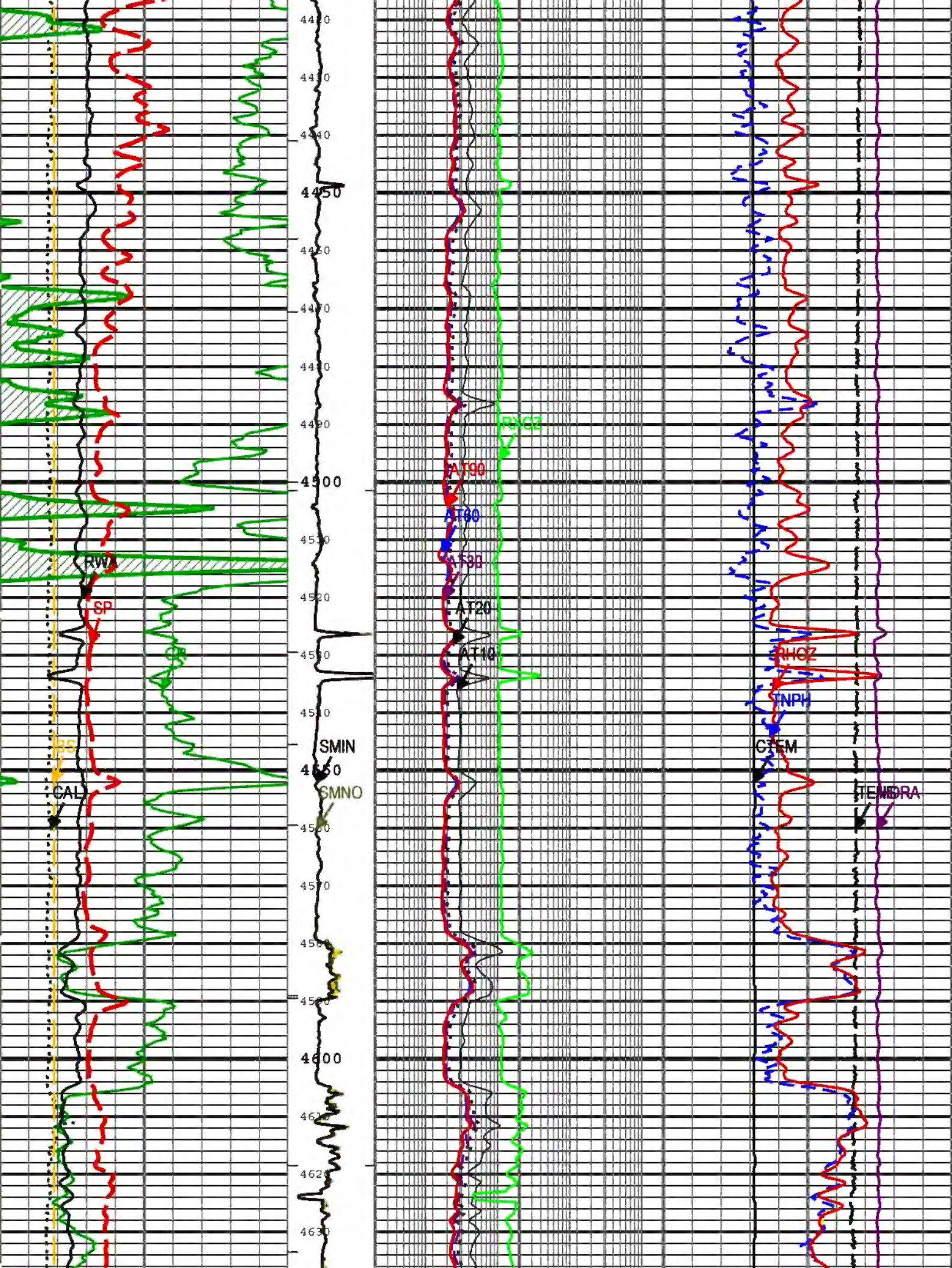
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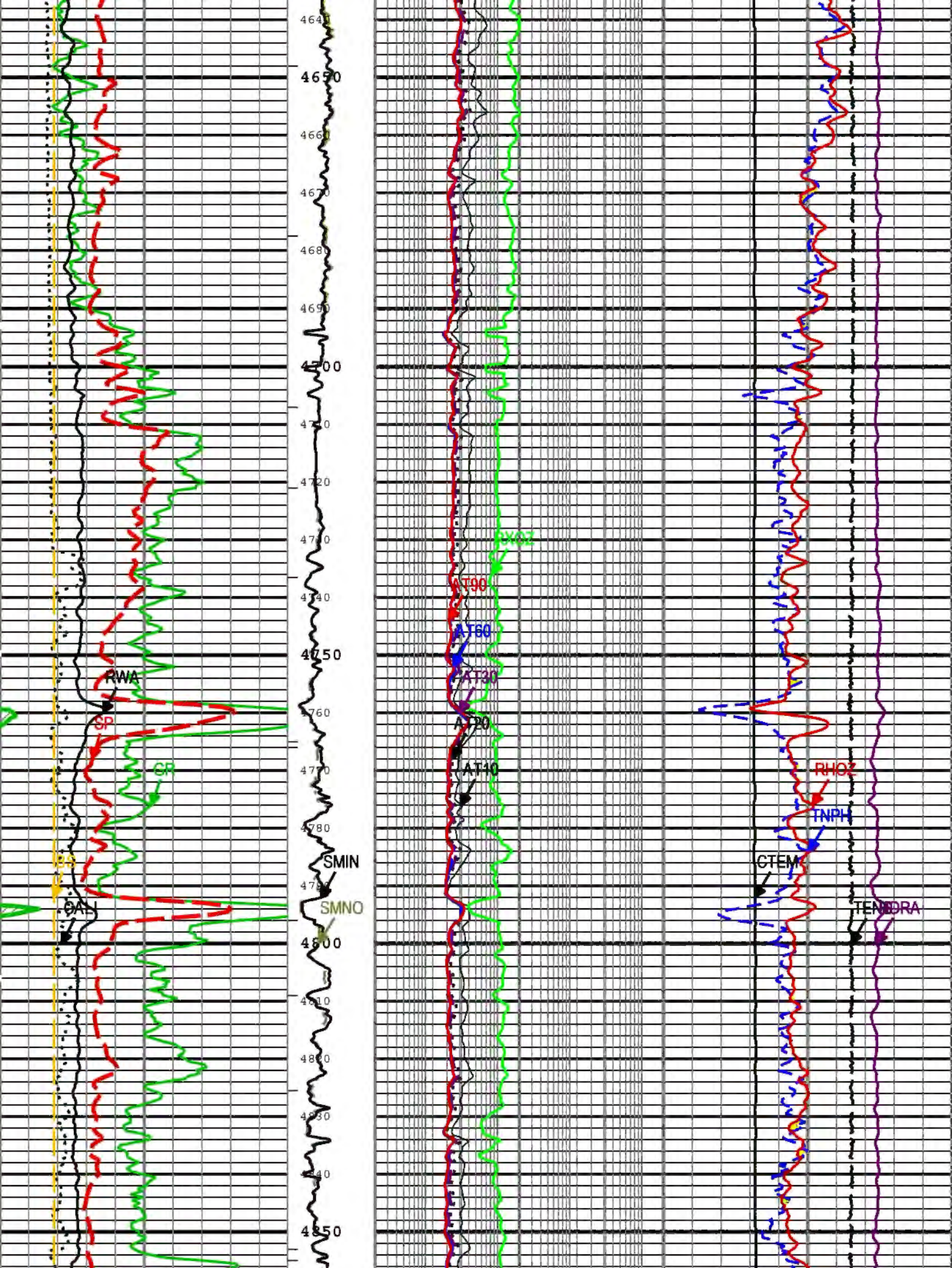
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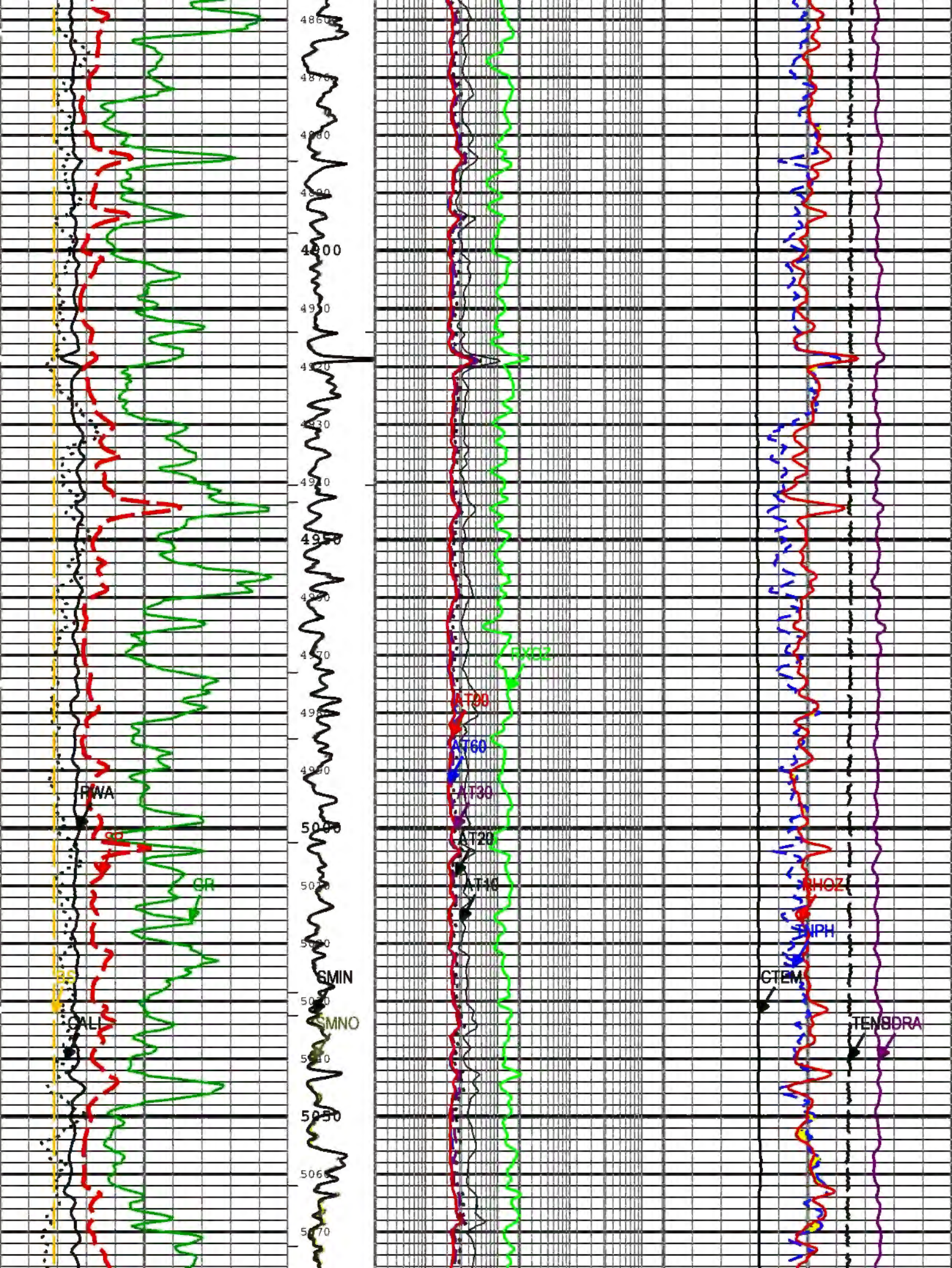
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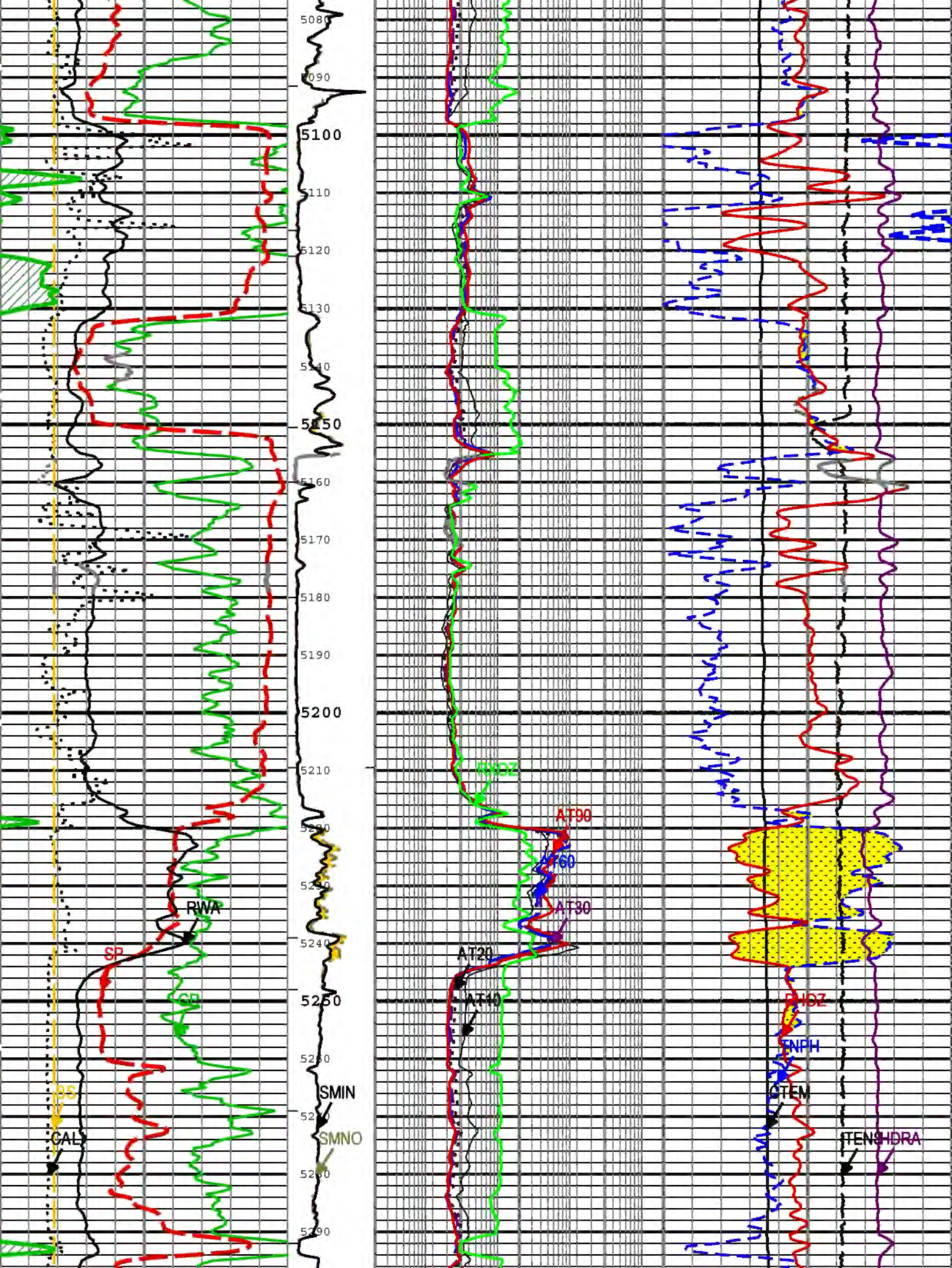
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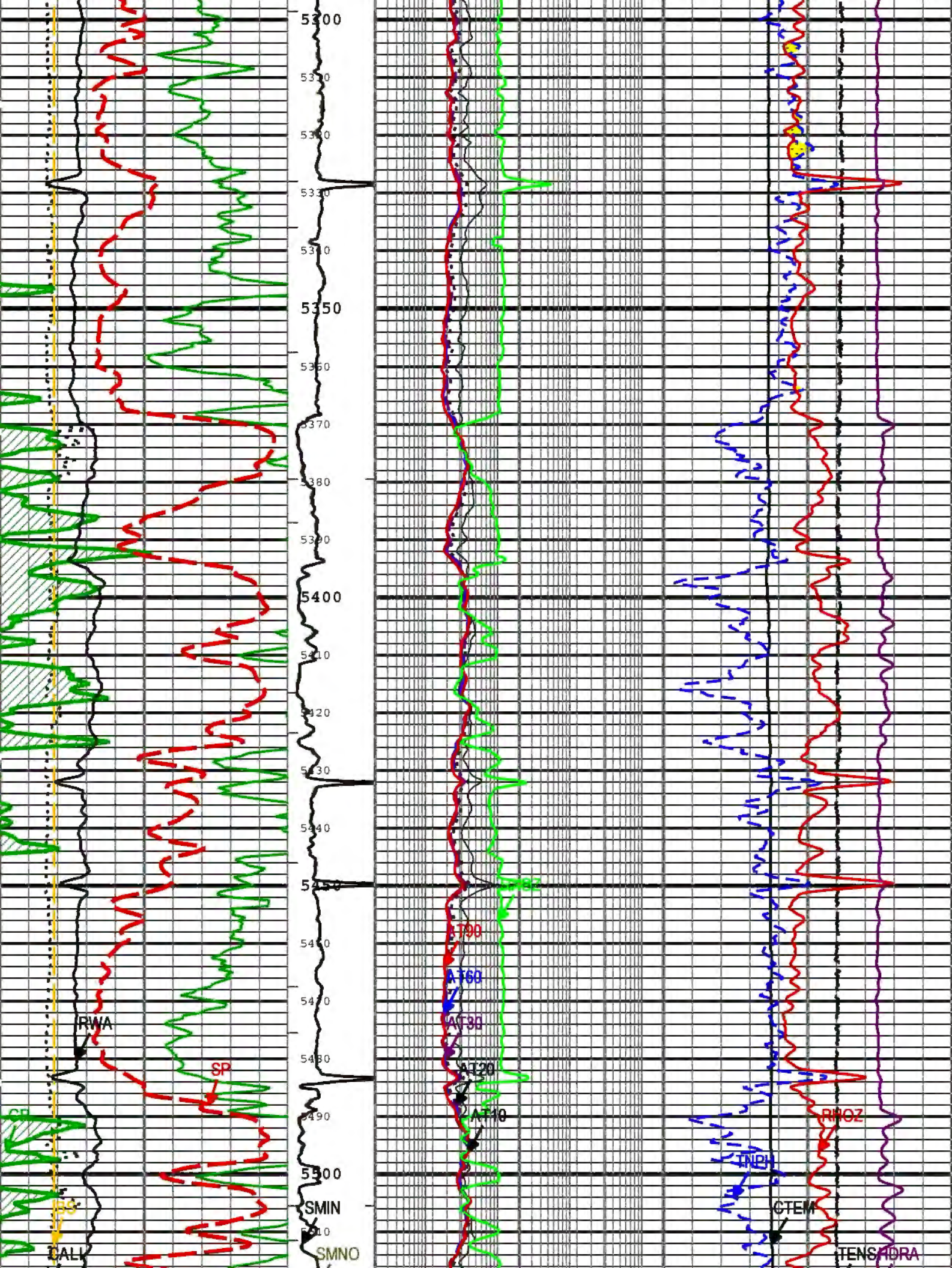
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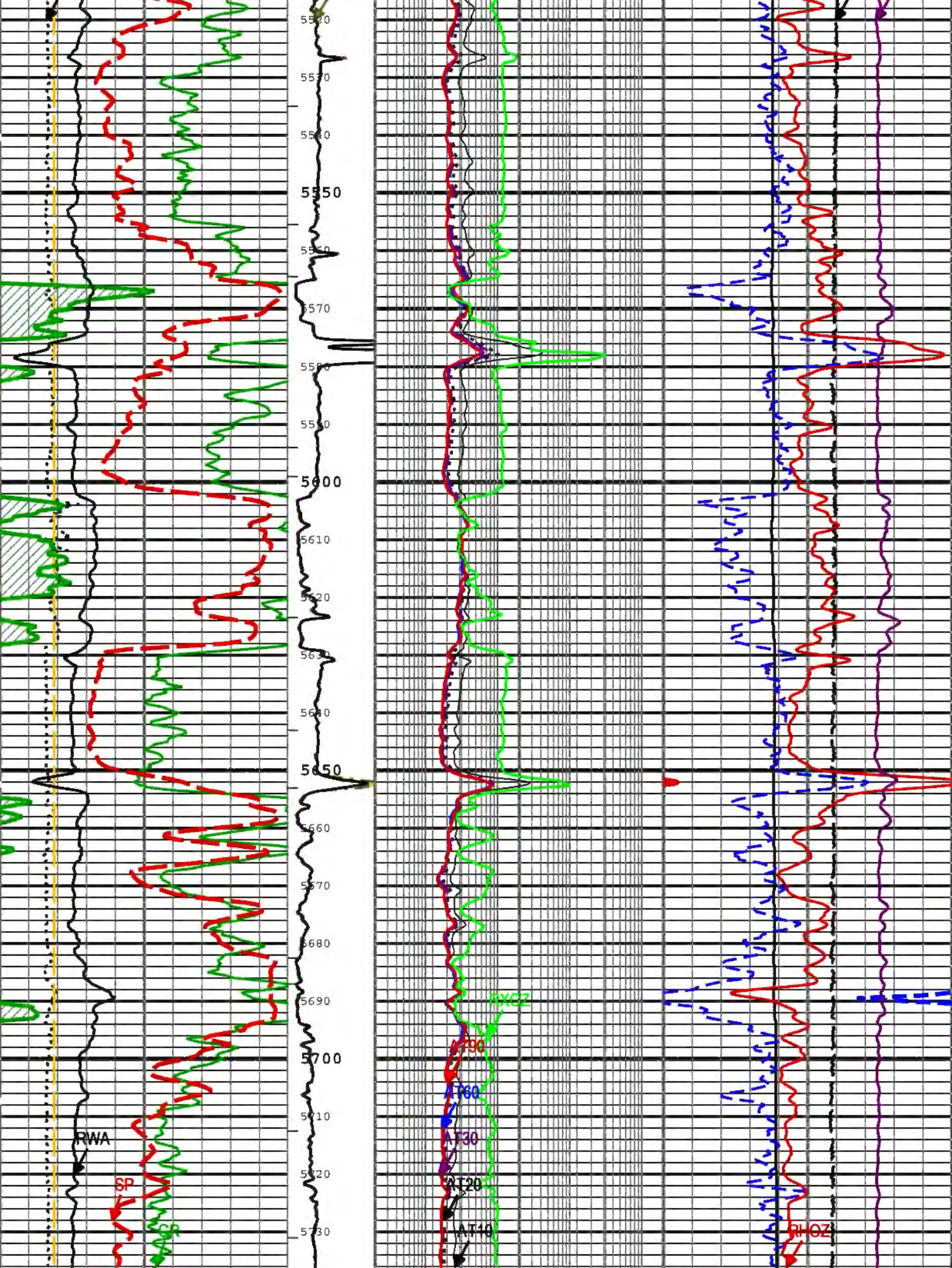
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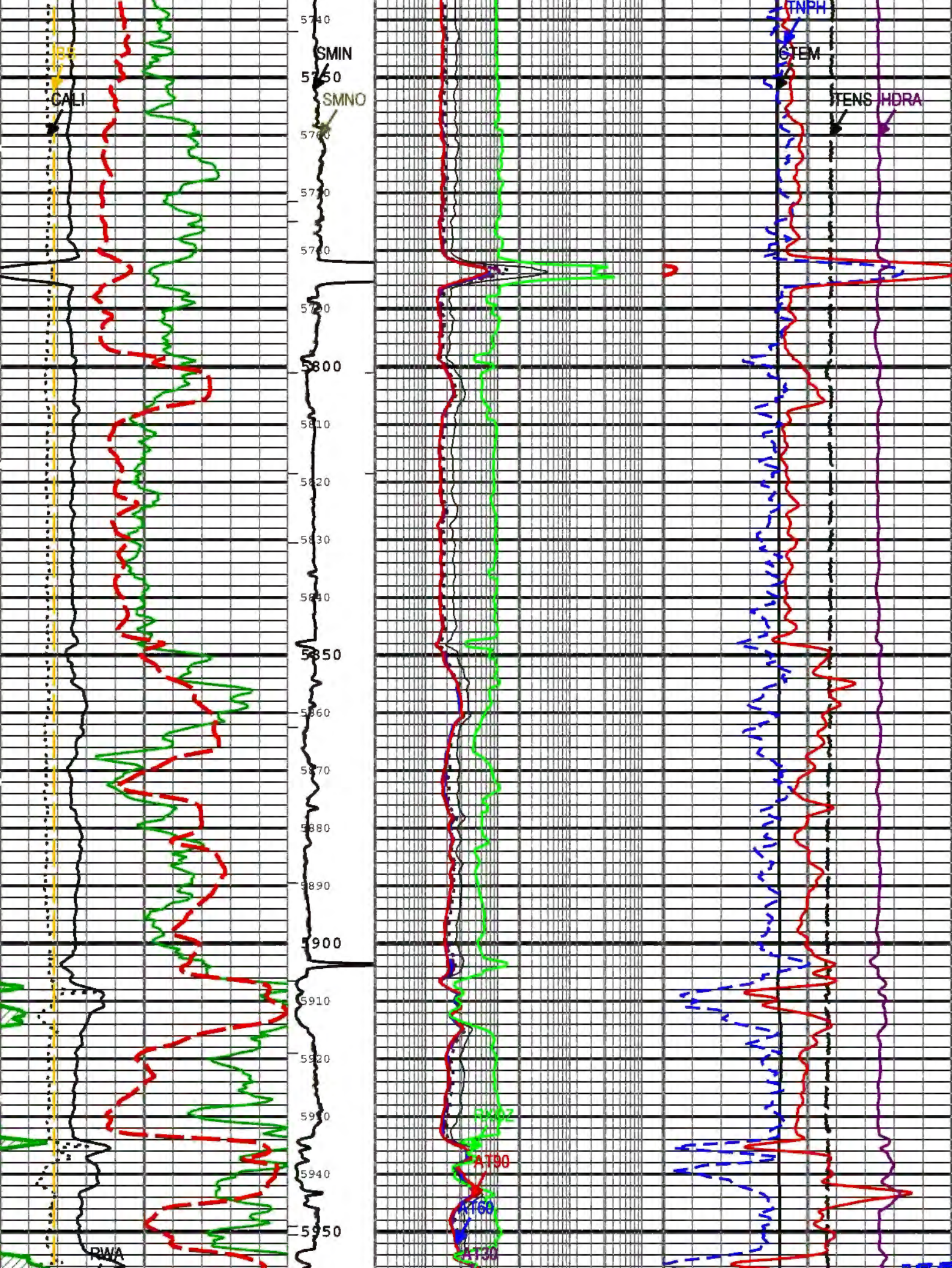
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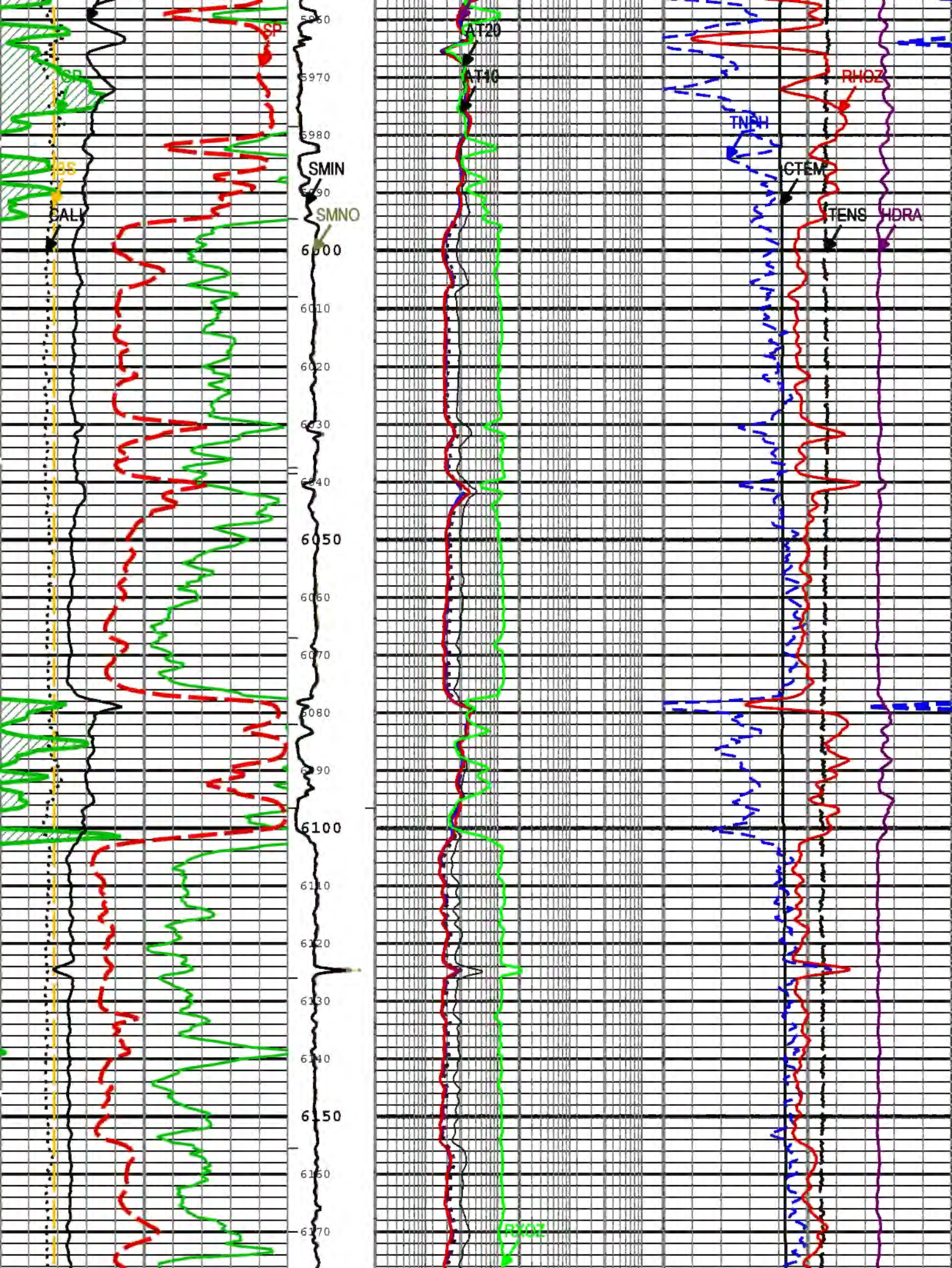
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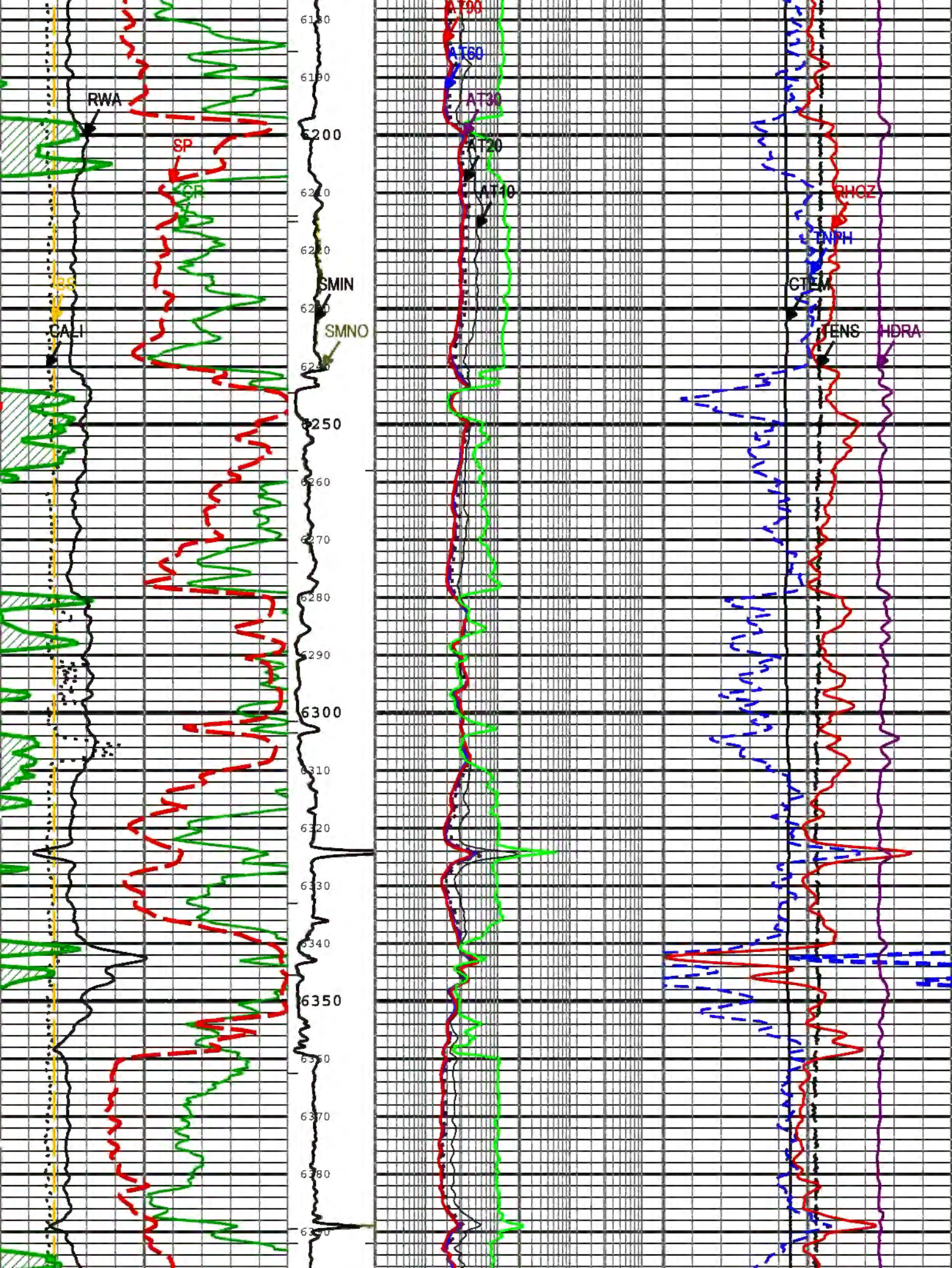
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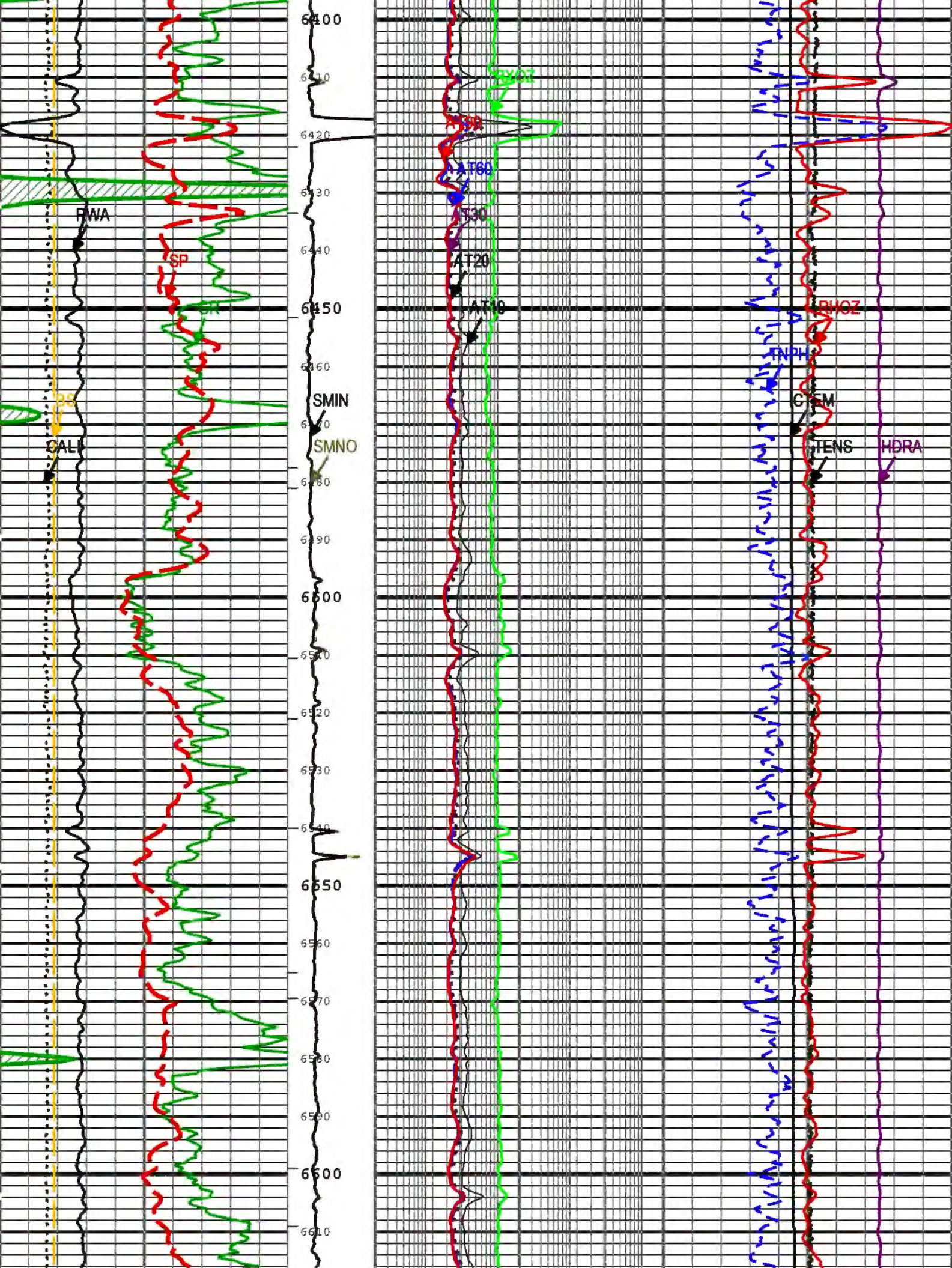
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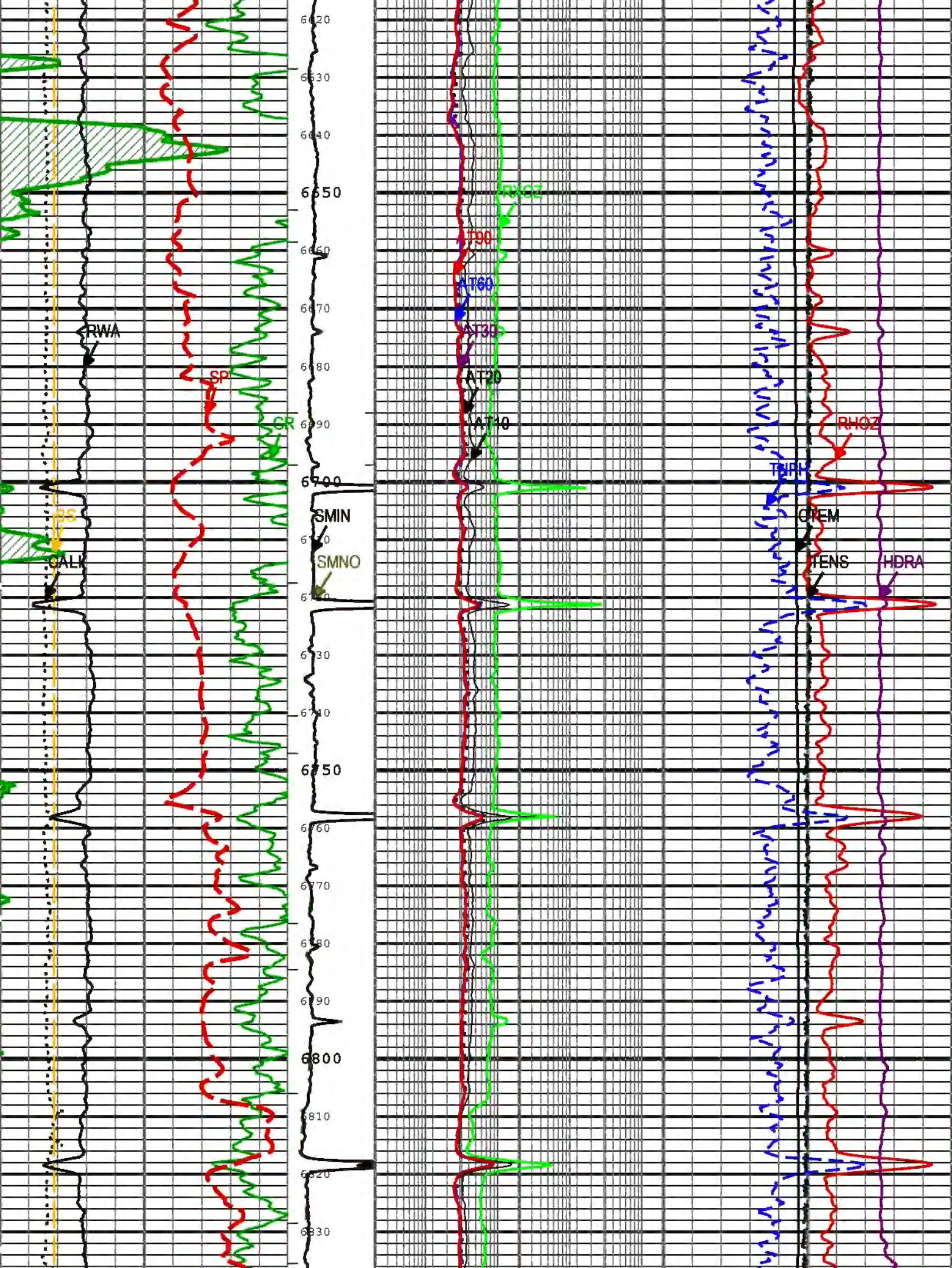
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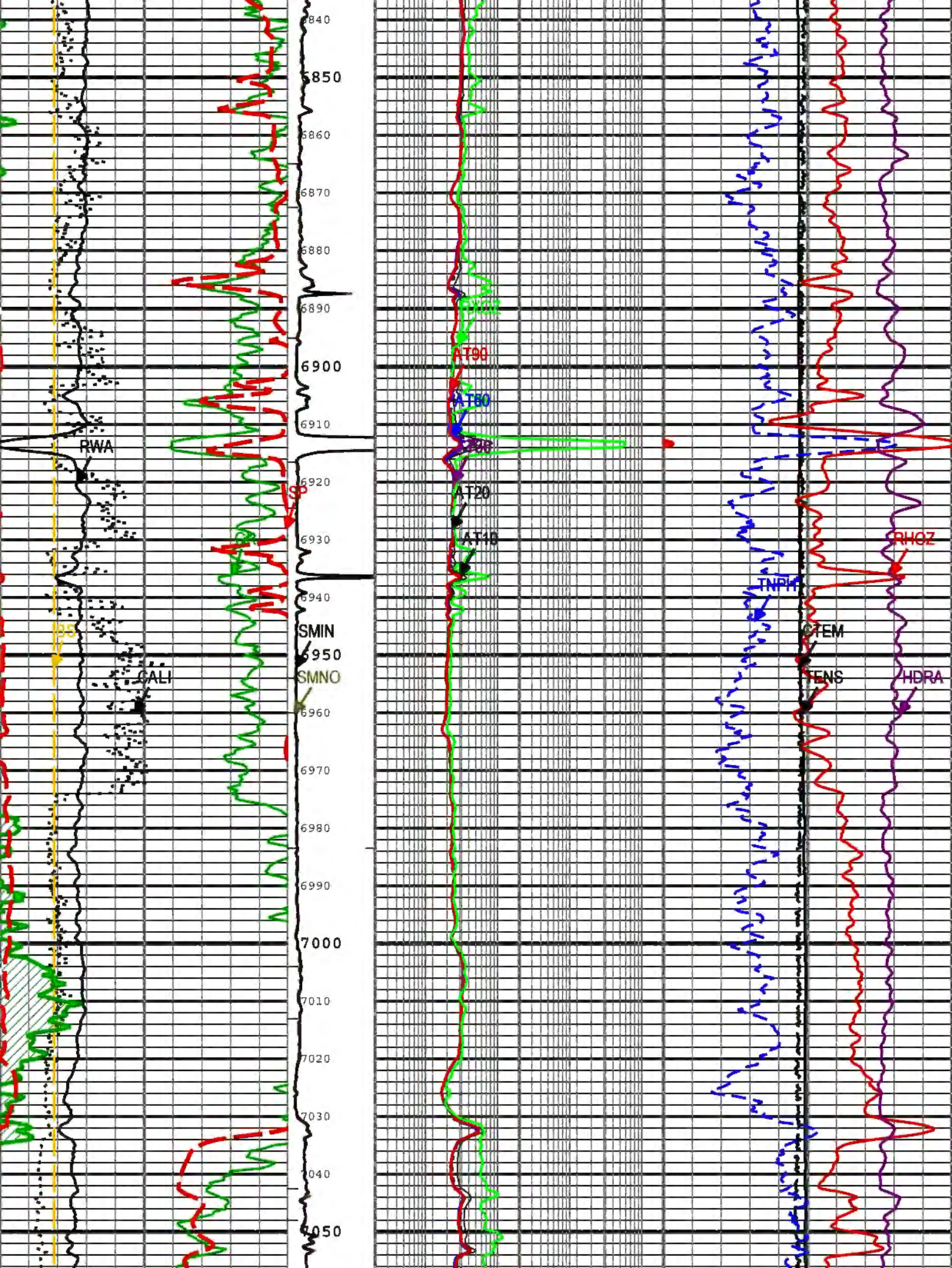
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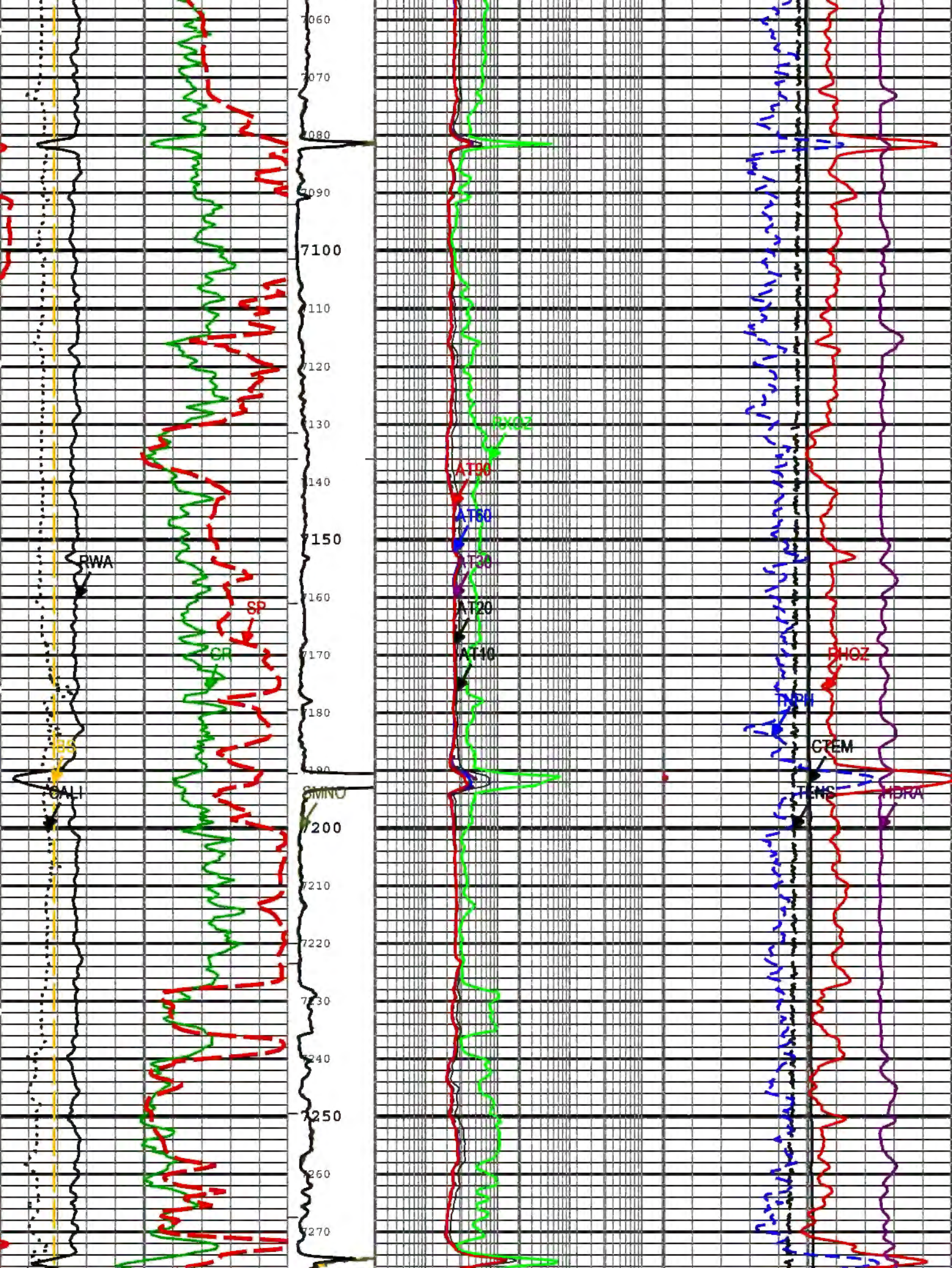
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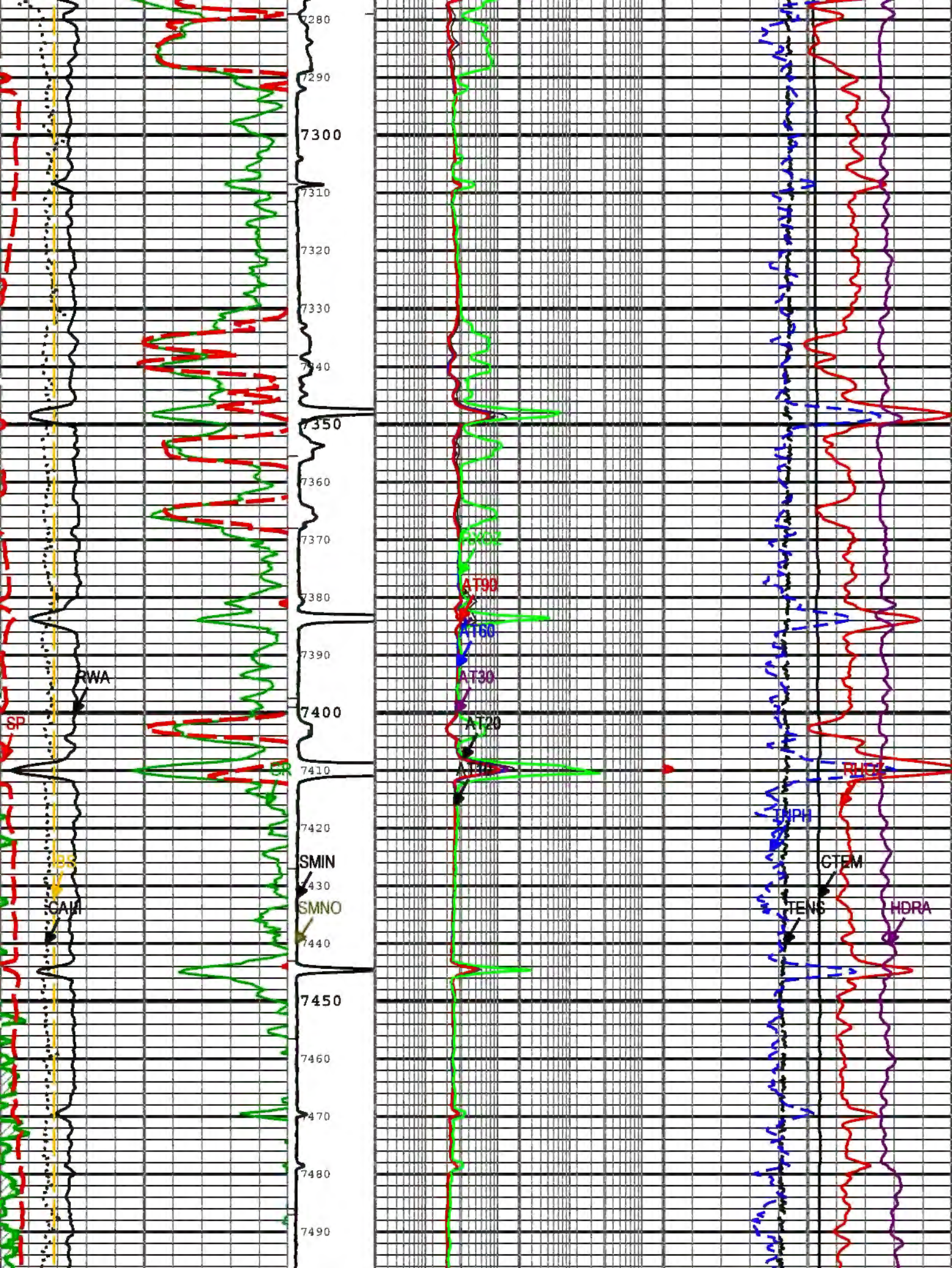

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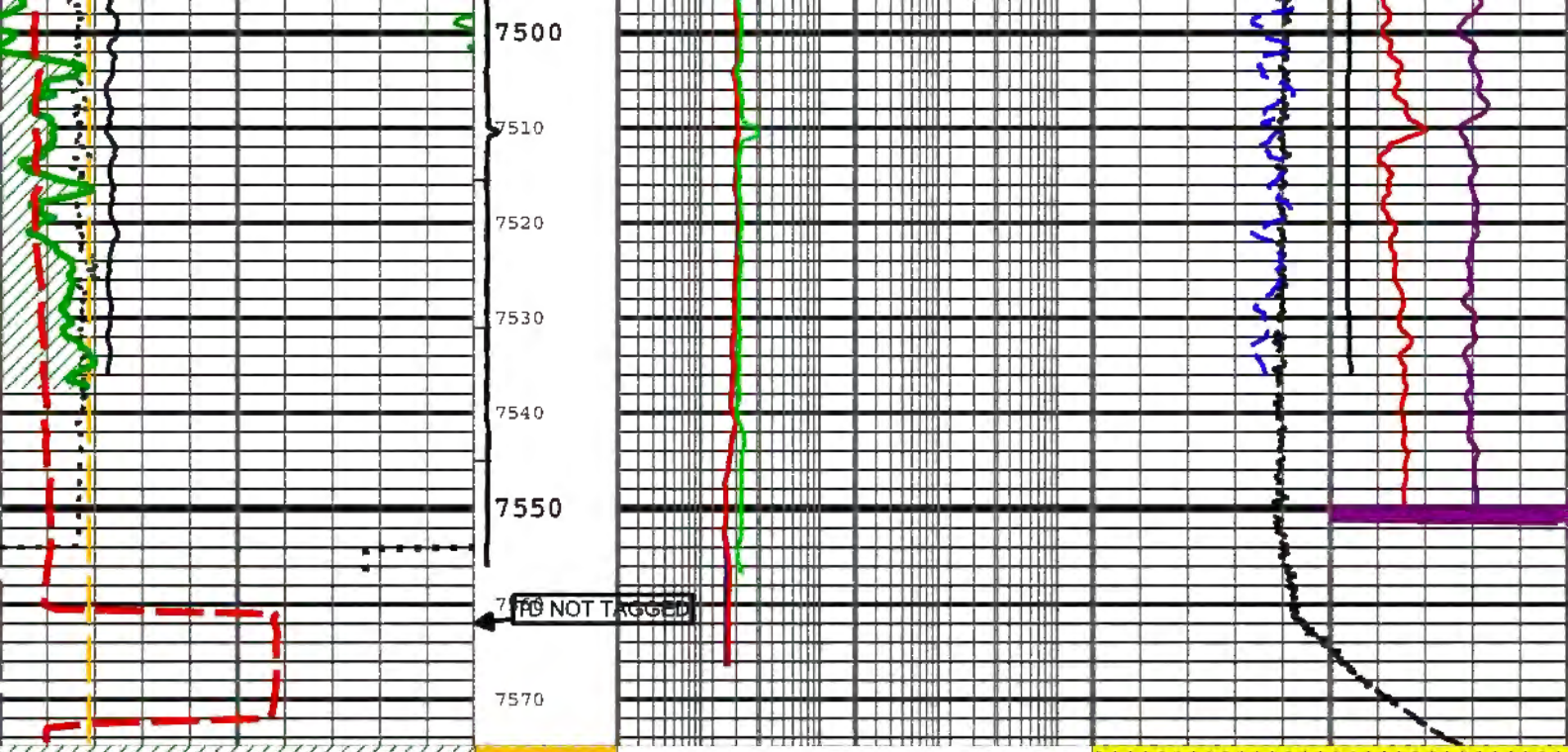


GR Backup

Caliper (CALI) HDRS-B
6 in 16

Bit Size (BS)
6 in 16

Gamma Ray (GR) HGNS-B
0 gAPI 150

Spontaneous Potential (SP) AIT-H
-100 mV 0

Apparent Formation Water Resistivity (RWA)
0.02 ohm.m 200

Perm Indicator

Synthetic Micro-Normal Resistivity (SMNO) HDRS-B
0 ohm.m 20

Synthetic Micro-Inverse Resistivity (SMIN) HDRS-B
0 ohm.m 20

Array Induction Two Foot Resistivity A10 (AT10) AIT-H
0.2 ohm.m 2000

Array Induction Two Foot Resistivity A20 (AT20) AIT-H
0.2 ohm.m 2000

Array Induction Two Foot Resistivity A30 (AT30) AIT-H
0.2 ohm.m 2000

Array Induction Two Foot Resistivity A60 (AT60) AIT-H
0.2 ohm.m 2000

Array Induction Two Foot Resistivity A90 (AT90) AIT-H
0.2 ohm.m 2000

Invaded Formation Resistivity filtered at 18 inches (RXOZ) HDRS-B
0.2 ohm.m 2000

Crossover

Cable Tension (TENS)
10000 lbf 0

Cartridge Temperature (CTEM) HGNS-B
100 degF 200

Thermal Neutron Porosity (Ratio Method) in Selected Lithology (TNPH) HGNS-B
0.6 m3/m3 0

Standard Resolution Formation Density (RHOZ) HDRS-B
1.65 g/cm3 2.65

Density Standoff Correction (HDRA) HDRS-B
-0.25 g/cm3 0.25

ICV - Integrated Cement Volume every 10.00 (ft3)

IHV - Integrated Hole Volume every 10.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

IHV - Integrated Hole Volume every 100.00 (ft3)

ICV - Integrated Cement Volume every 100.00 (ft3)

Description: HGNS standard resolution porosities for Platform Express Format: Log (5 in) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured D
Date: 21-Dec-2011 04:14:35

Channel Processing Parameters

Parameter	Description	ToolPath	Value	Unit
A	Constant A of the Archie Formation Factor - Porosity Equation	Borehole	1	
AAPL	Array Induction Answer Product Level(Depth Log/View only)	AIT-H:AHIS:AHIS	Radial	

ABHM	Array Induction Borehole Correction Mode	AIT-H:AHIS:AHIS	Compute Standoff	
ABLM	Array Induction Basic Logs Mode	AIT-H:AHIS:AHIS	Normal	
ACDE	Array Induction Casing Detection Enable	AIT-H:AHIS:AHIS	No	
ACEN	Array Induction Tool Centering Flag (in Borehole)	AIT-H:AHIS:AHIS	Eccentered	
AMRF	Array Induction Mud Resistivity Factor	AIT-H:AHIS:AHIS	1	
ARPM	Array Induction Radial Processing Mode	AIT-H:AHIS:AHIS	One Two Four	
ASTA	Array Induction Tool Standoff	AIT-H:AHIS:AHIS	1.7	in
ATSE	Array Induction Temperature Selection(Sonde Error Correction)	AIT-H:AHIS:AHIS	Internal	
AZ_ENABLE	Z-Axis Acceleration Channel Enabled for Real-Time Depth Correction	DepthCorrection	No	
BARI	Barite Mud Presence Flag	Borehole	No	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	COMPLETION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	320	ppm
BSCO	Borehole Salinity Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
CALI_SHIFT	CALI Supplementary Offset	HDRS-B:HRCC-B:HRCC-B	0.157	in
CBLO	Casing Bottom (Logger)	COMPLETION	516	ft
CCCO	Casing & Cement Thickness Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
CDEN	Cement Density	HGNS-B:HGNS-B:HGNS-B	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	COMPLETION	Depth Zoned	in
DC_MODE	Depth Correction Mode	DepthCorrection	Real-time	
DC_RT_ENABLE	Depth Correction Real-Time Enabled	DepthCorrection	No	
DCOD	Density Detection Level for Coal	PEQL	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.2	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	Klaycon	
DHC	Density Hole Correction	HDRS-B:HRMS-B:HRGD-B	Bit Size	
DSAD	Density Detection Level for Salt	PEQL	2.1	g/cm3
EXSICL	External Shale Indicator Channel Clean Value	PEQL	20	
EXSISH	External Shale Indicator Channel Shale Value	PEQL	150	
FCD	Future Casing (Outer) Diameter	COMPLETION	4.5	in
FSAL	Formation Salinity	Borehole	6126.75	ppm
FSCO	Formation Salinity Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
GCLF	Coal-Like Formation	HDRS-B:HRMS-B:HRGD-B	No	
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	BS	
GR_MULTIPLIER	Gamma Ray Multiplier	HGNS-B:HGNS-B:HGNS-B	1	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-B:HGNS-B:HGNS-B	Yes	
HVCS	Integrated Hole Volume Caliper Selection	Borehole	Compute Area from GHD	
IHVC	Integrated Hole Volume Control	Borehole	Start	
M	Exponent M of the Archie Formation Factor - Porosity Equation	Borehole	2	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MCCO	Mud Cake Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
MFST	Mud Filtrate Sample Temperature	Borehole	73.1	degF
MHCC	Switch to select MCFL High Contrast Correction	HDRS-B:HRMS-B:HRGD-B	No	
MPOF	MCFL Processing Operation Mode	HDRS-B:HRMS-B:HRGD-B	On	
MWCO	Mud Weight Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
N	N Exponent in SW Formula	Borehole	2	
NAAC	Switch for the correction of formation activation by the ARS	HDRS-B:HRMS-B:HRGD-B	Off	

NCOD	Neutron Detection Level for Coal	PEQL	0.45	ft3/ft3
NPRM	HRDD Nuclear Processing Mode	HDRS-B:HRMS-B:HRGD-B	Standard Resolution	
NSAD	Neutron Detection Level for Salt	PEQL	0.05	ft3/ft3
NTCO	HRDD Nuclear Temperature Correction Option	HDRS-B:HRMS-B:HRGD-B	On	
PHIMAX	Maximum Porosity Limit	PEQL	0.35	ft3/ft3
PTCO	Pressure Temperature Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
RMFS	Resistivity of Mud Filtrate Sample	Borehole	2.57	ohm.m
RW	Connate Water Resistivity	Borehole	1	ohm.m
SOCN	Standoff Distance	HGNS-B:HGNS-B:HGNS-B	0.125	in
SOCO	Standoff Correction Option	HGNS-B:HGNS-B:HGNS-B	No	
SP_SHIFT	SP Shift	AIT-H:AHIS:AHIS	-30	mV
SPDR	SP Drift Per Foot	AIT-H:AHIS:AHIS	0	mV/ft
TPOS	Tool Position: Centered or Eccentered	HGNS-B:HGNS-B:HGNS-B	Eccentered	
TWS	Connate Water Temperature	Borehole	68	degF

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	0	480	516
BS	7.875	516	7574.83
CSODDRL	[8.625]	480	517
CSODDRL	[0]	517	7574.83

All depth are actual.

Tool Control Parameters

Parameter	Description	ToolPath	Value	Unit
HMCA_BRD_TYPE	HMCA Board Type	HGNS-B:HGNS-B:HMCA-B	0	
HRGD_BRD_TYPE	HRGD Board Type	HDRS-B:HRMS-B:HRGD-B	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLWorkflow	3600	ft/h
NDTC	Nuclear Dead Time Correction	HDRS-B:HRMS-B:HRGD-B	On	
NPUC	Nuclear Pile-Up Correction	HDRS-B:HRMS-B:HRGD-B	Off	
STSO_HRDD	Temperature Source for the Density Algorithm	HDRS-B:HRMS-B:HRGD-B	HET data channel	

One

Main Pass 5" = 100 ft Repeat

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift
One	Log[3]:Up	Up	366.35 ft	7574.85 ft	20-Dec-2011 6:53:20 PM	20-Dec-2011 9:07:14 PM	14.58 ft
One	Log[4]:Up	Up	499.13 ft	738.87 ft	20-Dec-2011 9:36:31 PM	20-Dec-2011 9:41:31 PM	15.63 ft

All depths are referenced to toolstring zero

Log

One: Log[4]:Up 7D55AF97-C976-472D-84D1-E9EC641C04CC

Description: HGNS standard resolution porosities for Platform Express Format: Log (5 in RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measure
Date: 21-Dec-2011 04:14:42

Channel	Source	Sampling
ICV	Borehole	6in
IHV	Borehole	6in
TIME_1900	WLWorkflow	0.1in

ICV - Integrated Cement Volume every 100.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

IHV - Integrated Hole Volume every 100.00 (ft3)

IHV - Integrated Hole Volume every 10.00 (ft3)

ICV - Integrated Cement Volume every 10.00 (ft3)

Main To Repeat

Repeat To Main

Caliper (CALI) HDRS-B

6 in 16

Main To Repeat

Repeat To Main

Synthetic Micro-Normal Resistivity (SMNO) HDRS-B

0 ohm.m 100

Main To Repeat

Repeat To Main

Synthetic Micro-Inverse Resistivity (SMIN) HDRS-B

0 ohm.m 100

Main To Repeat

Repeat To Main

Gamma Ray (GR) HGNS-B

150 gAPI 300

Main To Repeat

Repeat To Main

Spontaneous Potential (SP) AIT-H

-100 mV 0

Main To Repeat

Repeat To Main

Bit Size (BS)

6 in 16

Main To Repeat

Repeat To Main

Gamma Ray (GR) HGNS-B

0 gAPI 150

Main To Repeat

Repeat To Main

Synthetic Micro-Normal Resistivity (SMNO) HDRS-B

0 ohm.m 20

Main To Repeat

Repeat To Main

Synthetic Micro-Inverse Resistivity (SMIN) HDRS-B

0 ohm.m 20

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A60 (AT60) AIT-H

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A10 (AT10) AIT-H

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A20 (AT20) AIT-H

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A90 (AT90) AIT-H

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Invaded Formation Resistivity filtered at 18 inches (RXOZ) HDRS-B

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A30 (AT30) AIT-H

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Density Standoff Correction (HDRA) HDRS-B

-0.25 g/cm3 0.25

Main To Repeat

Repeat To Main

Cartridge Temperature (CTEM) HGNS-B

100 degF 200

Main To Repeat

Repeat To Main

Thermal Neutron Porosity (Ratio Method) in Selected Lithology (TNPH) HGNS-B

0.6 m3/m3 0

Main To Repeat

Repeat To Main

Standard Resolution Formation Density (RHOZ) HDRS-B

1.65 g/cm3 2.65

Main To Repeat

Repeat To Main

Cable Tension (TENS)

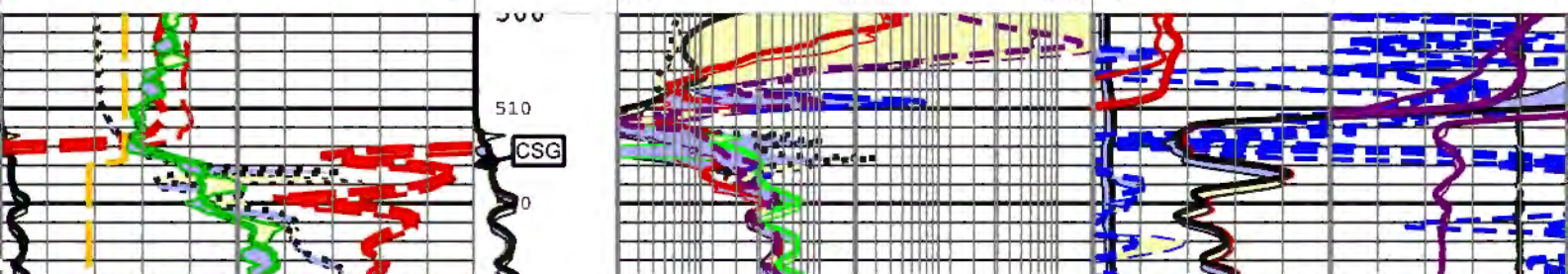
10000 lbf 0

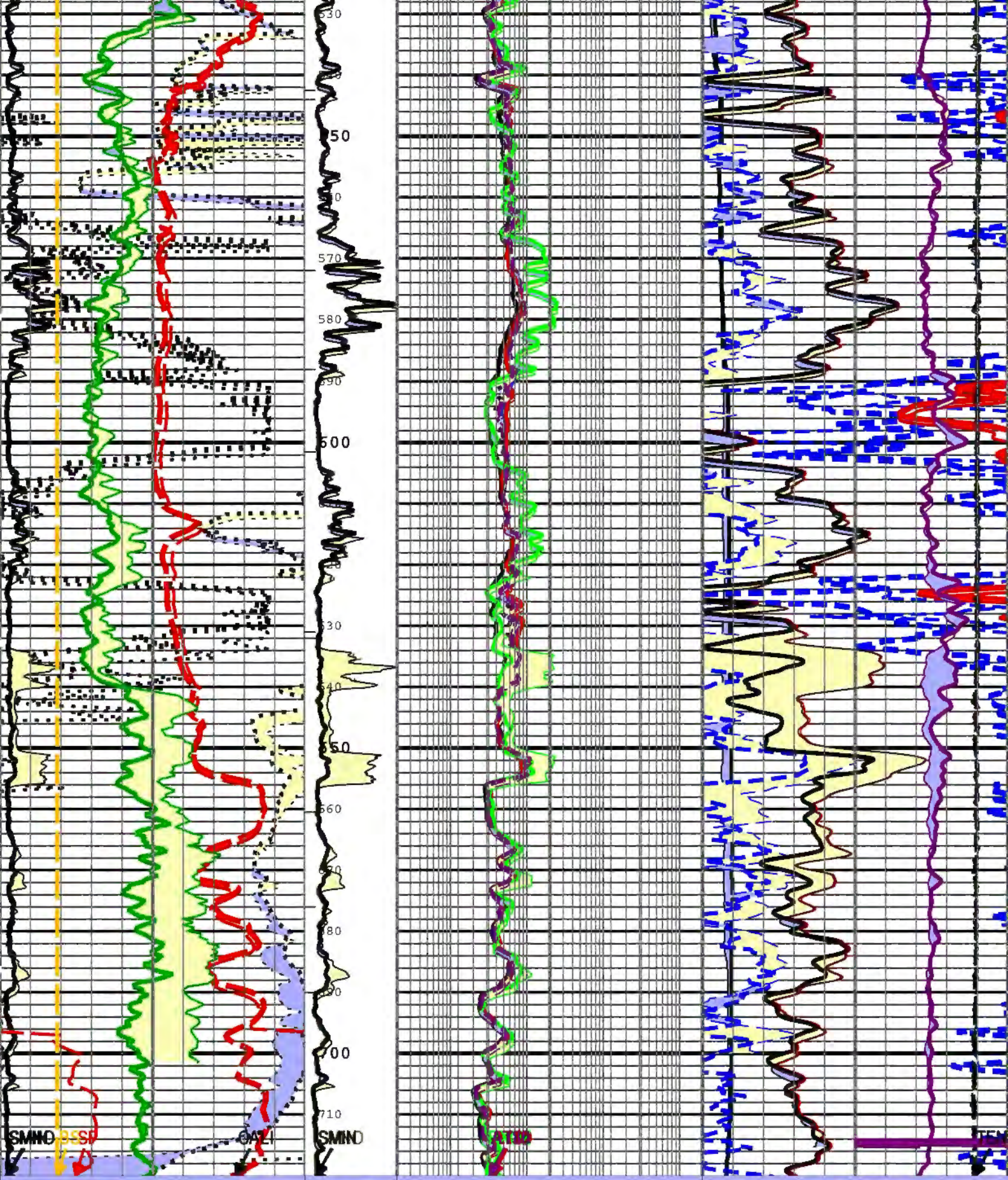
Main To Repeat

Repeat To Main

Standard Resolution Density Porosity (DPHZ) HDRS-B

0.6 ft3/ft3 0





Main To Repeat

Repeat To Main

Caliper (CALI) HDRS-B

6 in 16

Main To Repeat

Repeat To Main

Synthetic Micro-Normal

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A60 (AT60) AIT-H

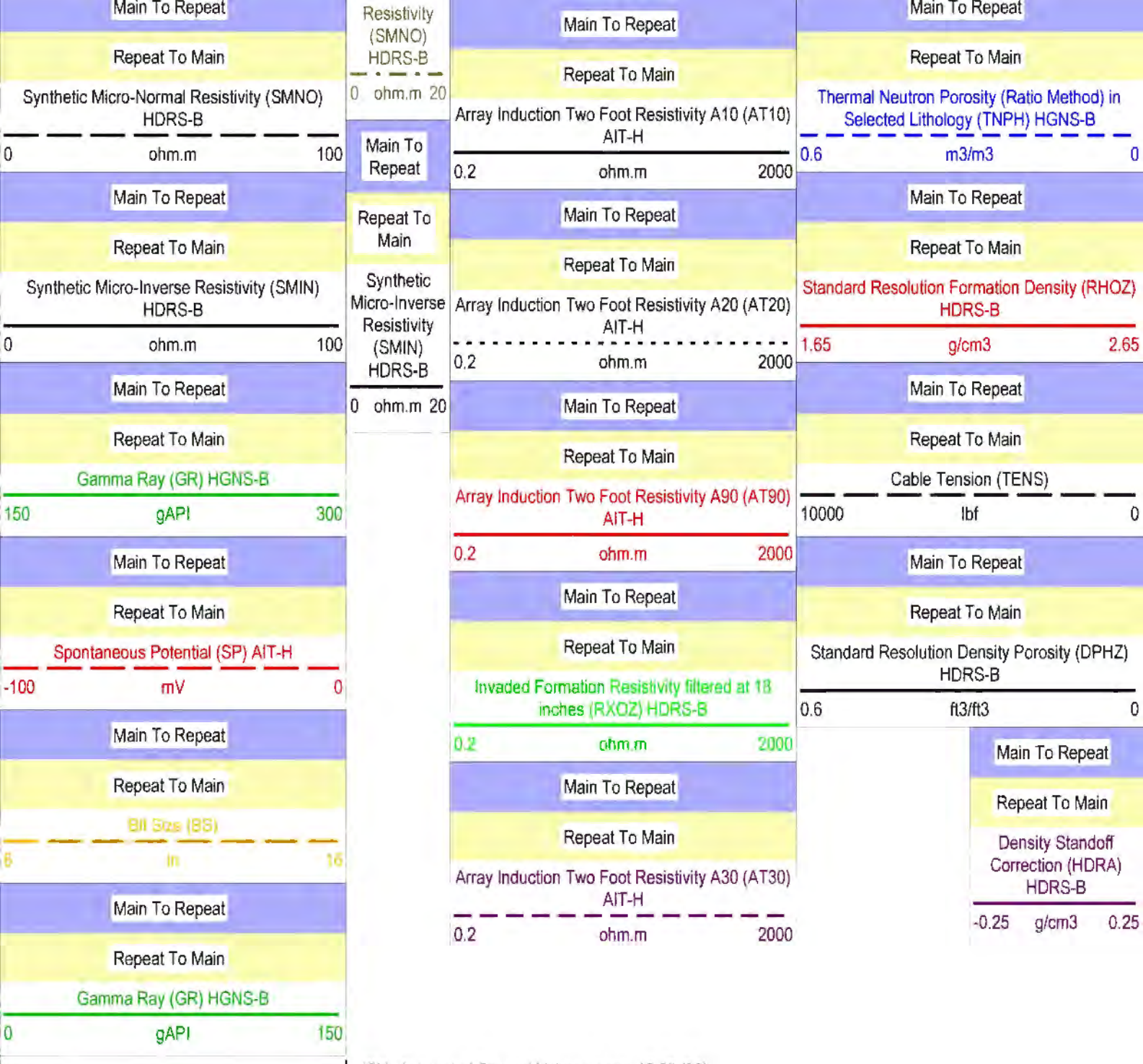
0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Cartridge Temperature (CTEM) HGNS-B

100 degF 200



Description: HGNS standard resolution porosities for Platform Express Format: Log (5 in RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measure
Date: 21-Dec-2011 04:14:42

One

SP Check

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit

Software Version

Acquisition System	Version

MaxWell	3.0.9609.0
Application Patch	SP-20110816-3.0.9609.1150

Tool Elements	Description	Software Version	Firmware Version
AHIS	Array Induction Sonde - H	3.0.9609.1150	

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift
One	Log[1]:Up	Up	9188.83 ft	9990.02 ft	19-Dec-2011 10:38:02 PM	19-Dec-2011 10:51:23 PM	0.00 ft

All depths are referenced to toolstring zero

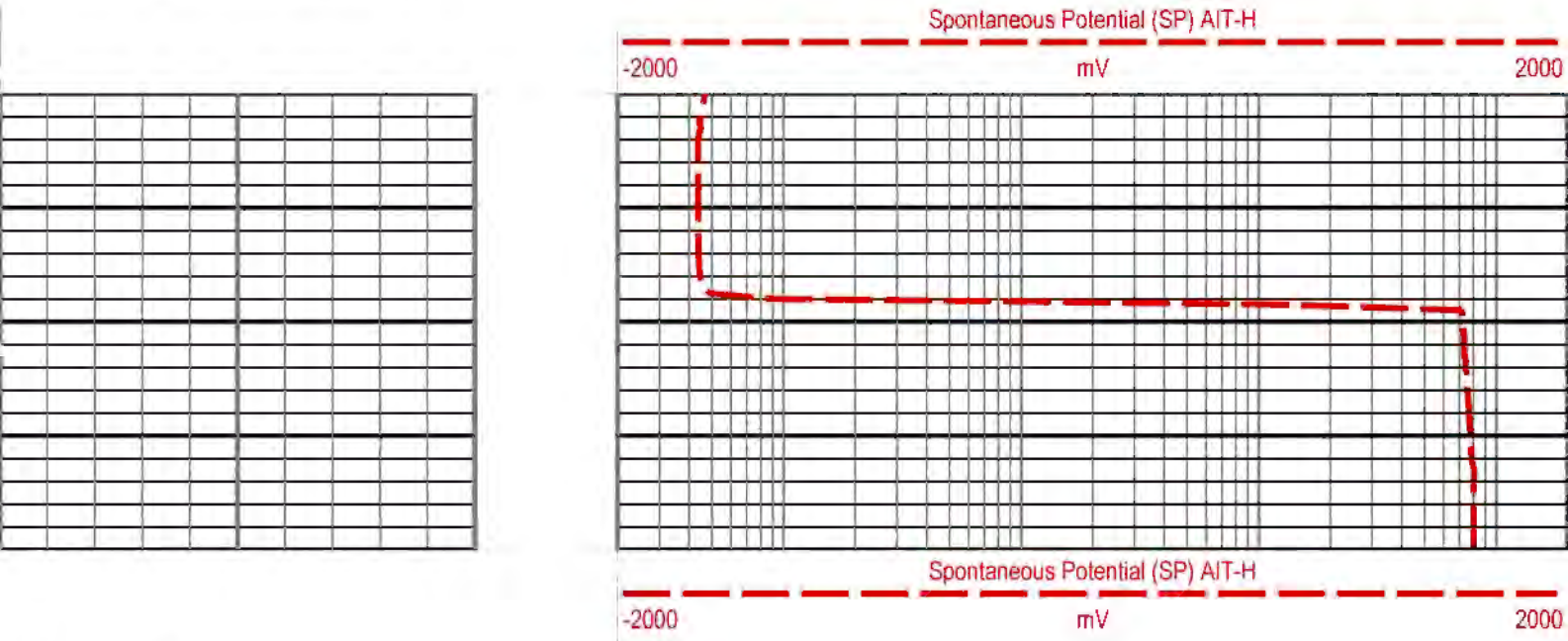
Log

One: Log[1]:Up 4F535C16-046D-4F85-A5F8-C00927A126CF

Description: AIT Log Format: Log (sp check) Index Scale: 6 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:43

Channel	Source	Sampling
SP	AIT-H:AHIS:AHIS	6in
TIME_1900	WLWorkflow	0.1in

TIME_1900 - Time Marked every 60.00 (s)



TIME_1900 - Time Marked every 60.00 (s)

Description: AIT Log Format: Log (sp check) Index Scale: 6 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:43

Channel Processing Parameters

Parameter	Description	ToolPath	Value	Unit
SP_SHIFT	SP Shift	AIT-H:AHIS:AHIS	-30	mV
SPDR	SP Drift Per Foot	AIT-H:AHIS:AHIS	0	mV/ft

Tool Control Parameters

One

MCFL Check

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit

Software Version

Acquisition System	Version
MaxWell	3.0.9609.0

Application Patch		SP-20110816-3.0.9609.1150	
Tool Elements	**Description**	**Software Version**	**Firmware Version**
HRGD-B	HILT Resistivity Gamma-Ray Density Device, 125 degC	3.0.9609.0	3.0

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	Depth Shift
One	Log[1]:Up	Up	9188.83 ft	9990.02 ft	19-Dec-2011 10:38:02 PM	19-Dec-2011 10:51:23 PM	0.00 ft

All depths are referenced to toolstring zero

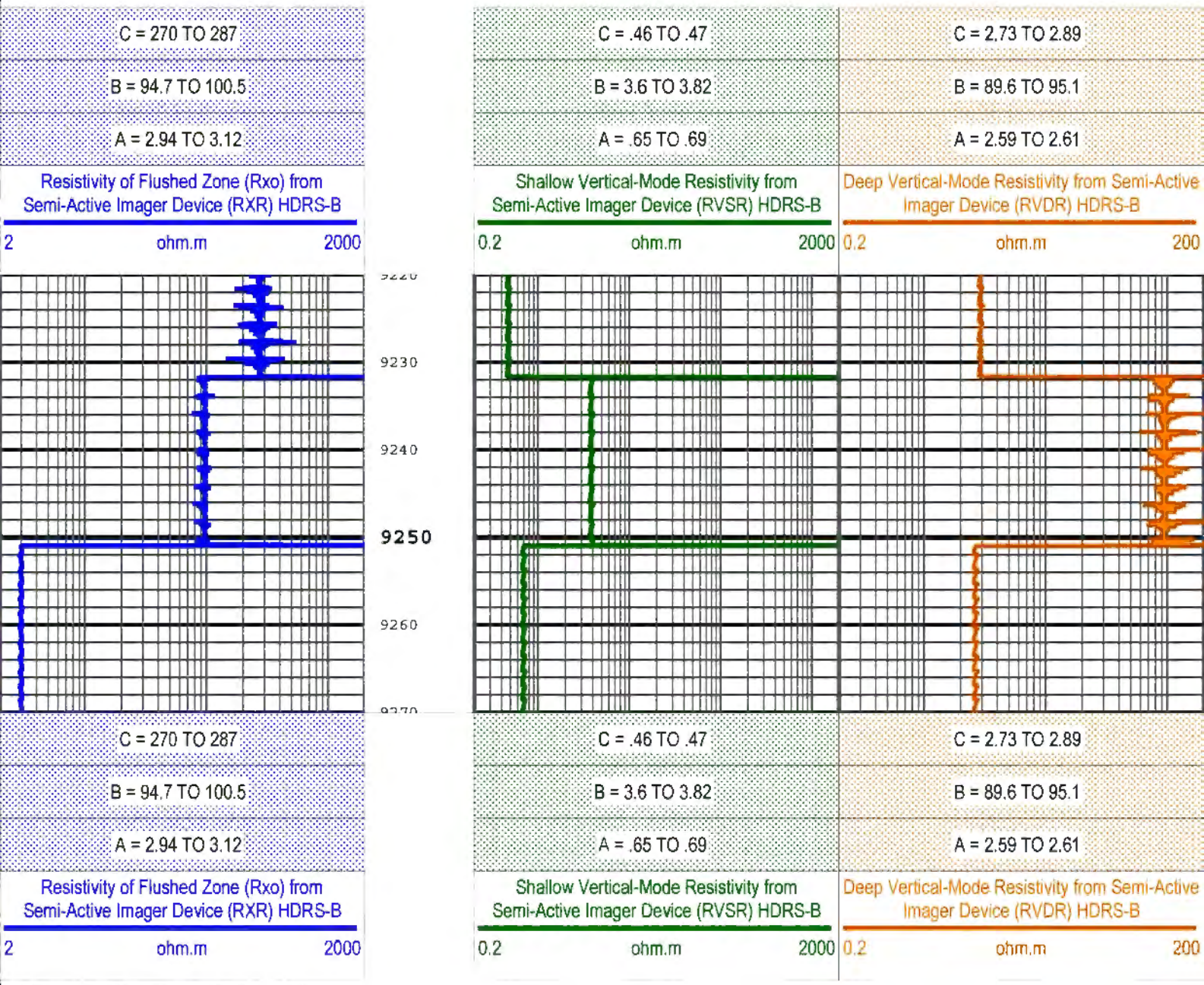
Log

One: Log[1]:Up 4F535C16-046D-4F85-A5F8-C00927A126CF

Description: MCFL hardware LQC for Platform Express Format: Log (PEX MCFL Box Check) Index Scale: 6 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:44

Channel	Source	Sampling
RVDR	HDRS-B:HRMS-B:HRGD-B	0.2in
RVSR	HDRS-B:HRMS-B:HRGD-B	0.2in
RXR	HDRS-B:HRMS-B:HRGD-B	0.2in
TIME_1900	WLWorkflow	0.1in

TIME_1900 - Time Marked every 60.00 (s)



TIME_1900 - Time Marked every 60.00 (s)

Description: MCFL hardware LQC for Platform Express Format: Log (PEX MCFL Box Check) Index Scale: 6 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 21-Dec-2011 04:14:44

Measured Depth -- Creation Date: 21-Dec-2011 01:17:11

Channel Processing Parameters

Tool Control Parameters

Parameter	Description	ToolPath	Value	Unit
HRGD_BRD_TYPE	HRGD Board Type	HDRS-B:HRMS-B:HRGD-B	WITH_HET	

Calibration Report

AIT-H (Array Induction Tool - H) Calibration - Run 2

Primary Equipment :

Array Induction Sonde - H — AHIS — 390

Auxiliary Equipment :

AITH Rm/SP Bottom Nose — AHRM — 390

AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 18:16:10 06-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Test Loop Gain - 0		Master	1.000	0.950	1.014	1.050
Test Loop Phase - 0	deg	Master	0	-3.000	0.696	3.000
Test Loop Gain - 1		Master	1.000	0.950	1.013	1.050
Test Loop Phase - 1	deg	Master	0	-3.000	0.537	3.000
Test Loop Gain - 2		Master	1.000	0.950	1.020	1.050
Test Loop Phase - 2	deg	Master	0	-3.000	-0.145	3.000
Test Loop Gain - 3		Master	1.000	0.950	1.020	1.050
Test Loop Phase - 3	deg	Master	0	-3.000	0.026	3.000
Test Loop Gain - 4		Master	1.000	0.950	1.000	1.050
Test Loop Phase - 4	deg	Master	0	-3.000	-0.034	3.000
Test Loop Gain - 5		Master	1.000	0.950	0.989	1.050
Test Loop Phase - 5	deg	Master	0	-3.000	-0.222	3.000
Test Loop Gain - 6		Master	1.000	0.950	0.995	1.050
Test Loop Phase - 6	deg	Master	0	-3.000	0.091	3.000
Test Loop Gain - 7		Master	1.000	0.950	1.009	1.050
Test Loop Phase - 7	deg	Master	0	-3.000	-0.317	3.000

AIT Sonde Calibration - Sonde Error Correction

Master (EEPROM): 18:16:10 06-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Sonde Error Correction Real - 0	mS/m	Master	----	-231.000	-42.274	119.000
Sonde Error Correction Quad - 0		Master	----	-2250.000	-186.287	2250.000
Sonde Error Correction Real - 1	mS/m	Master	----	114.000	177.538	204.000
Sonde Error Correction Quad - 1		Master	----	-625.000	-98.431	625.000
Sonde Error Correction Real - 2	mS/m	Master	----	66.000	106.008	156.000
Sonde Error Correction Quad - 2		Master	----	-350.000	-181.549	350.000
Sonde Error Correction Real - 3	mS/m	Master	----	39.000	57.620	89.000
Sonde Error Correction Quad - 3		Master	----	-250.000	25.191	250.000
Sonde Error Correction Real - 4	mS/m	Master	----	15.000	24.871	35.000
Sonde Error Correction Quad - 4		Master	----	-63.000	-25.168	63.000
Sonde Error Correction Real - 5	mS/m	Master	----	4.000	14.043	24.000
Sonde Error Correction Quad - 5		Master	----	-50.000	-11.645	50.000
Sonde Error Correction Real - 6	mS/m	Master	----	5.000	11.974	15.000
Sonde Error Correction Quad - 6		Master	----	-30.000	-4.212	30.000
Sonde Error Correction Real - 7	mS/m	Master	----	-5.000	-2.796	5.000
Sonde Error Correction Quad - 7		Master	----	-30.000	0.558	30.000

AIT Mud Calibration - Mud Calibration Gain

Master (EEPROM): 18:16:10 06-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Coarse Gain		Master	1.000	0.800	0.927	1.200
Fine Gain		Master	1.000	0.800	0.871	1.200

AIT Electronics Check - Thru Calibration Check

Master (EEPROM): 18:16:10 06-Dec-2011 Before (Measured): 17:09:50 20-Dec-2011 After:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Thru Cal Mag - 0	V	Master	----	0.363	0.629	0.847
		Before	----	0.363	0.631	0.847

		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.002	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 0	deg	Master	-----	11.000	54.734	131.000
		Before	-----	11.000	54.543	131.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.191000000000003	-----
		After-Before	-----	-----	-----	-----
Thru Cal Mag - 1	V	Master	-----	0.762	1.294	1.778
		Before	-----	0.762	1.298	1.778
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.004	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 1	deg	Master	-----	10.000	53.625	130.000
		Before	-----	10.000	53.428	130.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.197000000000003	-----
		After-Before	-----	-----	-----	-----
Thru Cal Mag - 2	V	Master	-----	0.374	0.642	0.872
		Before	-----	0.374	0.644	0.872
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.002	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 2	deg	Master	-----	6.000	50.100	126.000
		Before	-----	6.000	49.895	126.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.204999999999998	-----
		After-Before	-----	-----	-----	-----
Thru Cal Mag - 3	V	Master	-----	0.422	0.729	0.986
		Before	-----	0.422	0.731	0.986
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.002	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 3	deg	Master	-----	5.000	49.309	125.000
		Before	-----	5.000	49.104	125.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.204999999999998	-----
		After-Before	-----	-----	-----	-----
Thru Cal Mag - 4	V	Master	-----	0.802	1.363	1.872
		Before	-----	0.802	1.367	1.872
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.004	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 4	deg	Master	-----	-1.000	43.189	119.000
		Before	-----	-1.000	42.978	119.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.210999999999999	-----
		After-Before	-----	-----	-----	-----
Thru Cal Mag - 5	V	Master	-----	1.173	1.994	2.737
		Before	-----	1.173	2.001	2.737
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.006999999999999	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 5	deg	Master	-----	-3.000	41.504	117.000
		Before	-----	-3.000	41.277	117.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.226999999999997	-----
		After-Before	-----	-----	-----	-----

		Before	-----	1.173	2.000	2.737
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.006999999999 9999	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 6	deg	Master	-----	-3.000	41.534	117.000
		Before	-----	-3.000	41.309	117.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.225000000000 001	-----
		After-Before	-----	-----	-----	-----
Thru Cal Mag - 7	V	Master	-----	0.849	1.479	1.981
		Before	-----	0.849	1.483	1.981
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.004	-----
		After-Before	-----	-----	-----	-----
Thru Cal Phase - 7	deg	Master	-----	-7.000	41.134	113.000
		Before	-----	-7.000	40.825	113.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	- 0.308999999999 998	-----
		After-Before	-----	-----	-----	-----
SPA Zero	mV	Master	-----	-50.000	0.096	50.000
		Before	-----	-50.000	0.156	50.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.060	-----
		After-Before	-----	-----	-----	-----
SPA Plus	mV	Master	-----	941.000	990.424	1040.000
		Before	-----	941.000	990.062	1040.000
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	-0.362	-----
		After-Before	-----	-----	-----	-----
Temperature Zero	V	Master	-----	-0.050	0.000	0.050
		Before	-----	-0.050	0.000	0.050
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.000	-----
		After-Before	-----	-----	-----	-----
Temperature Plus	V	Master	-----	0.870	0.917	0.960
		Before	-----	0.870	0.917	0.960
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	0.000	-----
		After-Before	-----	-----	-----	-----

HDRS-B (HILT Density and Rxo Sonde, 125 degC) Calibration - Run 2

Primary Equipment :

HILT High-Resolution Control Cartridge, 125 degC	HRCC-B	4769
HILT Resistivity Gemma-Ray Density Device, 125 degC	HRGD-B	3791

Auxiliary Equipment :

HRDD Backscatter Detector	Backscatter	26938
HRDD Long Spacing Detector	Long Spacing	28844
HRDD Short Spacing Detector	Short Spacing	0
Cesium 137 Gamma-Ray Logging Source	GSR-J	5108
HILT High-Resolution Control Cartridge, 125 degC	HRCC-B	4769
HILT High-Resolution Mechanical Sonde, 125 degC	HRMS-B	4701

Calibration Parameter :

Small Ring Size (Caliper Calibration Small Ring)	8.00
Large Ring Size (Caliper Calibration Large Ring)	12.00

HDRS Caliper Calibration - Caliper Accumulations

Before (Measured): 17:06:59 20-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit

Small Ring	in	Before	8.00	6.00	7.59	10.00
Large Ring	in	Before	12.00	9.00	11.92	15.00

HDRS Density Calibration - Inversion Results

Master (EEPROM): 13:16:00 11-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Rho Aluminum	g/cm3	Master	2.596	2.586	2.594	2.606
Rho Magnesium	g/cm3	Master	1.686	1.676	1.690	1.696
Pe Aluminum		Master	2.570	2.470	2.508	2.670
Pe Magnesium		Master	2.650	2.550	2.641	2.750

HDRS Density Calibration - Deviation Summary

Master (EEPROM): 13:16:00 11-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
BS Average Deviation	%	Master	0	-0.6000	0.1653	0.6000
BS Max Deviation	%	Master	0	-1.6000	0.3637	1.6000
SS Average Deviation	%	Master	0	-1.0000	0.7439	1.0000
SS Max Deviation	%	Master	0	-2.5000	2.1859	2.5000
LS Average Deviation	%	Master	0	-1.5000	1.1388	1.5000
LS Max Deviation	%	Master	0	-3.5000	2.1536	3.5000

HDRS Density Calibration - Background Summary

Master (EEPROM): 13:16:00 11-Dec-2011 Before (Measured): 17:14:01 20-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
BS Window Ratio		Master	1.0000	-----	0.7528	-----
		Before	0.7528	0.7152	0.7508	0.7904
		Before-Master	-----	-----	-0.0020	-----
BS Window Sum	1/s	Master	1	----	22573	----
		Before	22573	21444	22553	23701
		Before-Master	----	----	-20	----
SS Window Ratio		Master	1.0000	-----	0.4814	-----
		Before	0.4814	0.4574	0.4836	0.5055
		Before-Master	-----	-----	0.0022	-----
SS Window Sum	1/s	Master	1	----	10928	----
		Before	10928	10382	10930	11475
		Before-Master	----	----	2	----
LS Window Ratio		Master	1.0000	-----	0.2936	-----
		Before	0.2936	0.2789	0.2935	0.3083
		Before-Master	-----	-----	-0.0001	-----
LS Window Sum	1/s	Master	1	----	1152	----
		Before	1152	1094	1148	1210
		Before-Master	----	----	-4	----

HDRS Density Calibration - Photo-multiplier High Voltages

Master (EEPROM): 13:16:00 11-Dec-2011 Before (Measured): 17:14:01 20-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
BS PM High Voltage	V	Master	----	1000	1574	2400
		Before	----	1000	1617	2400
		Before-Master	----	-100	43	100
SS PM High Voltage	V	Master	----	1000	1643	2400
		Before	----	1000	1674	2400
		Before-Master	----	-100	31	100
LS PM High Voltage	V	Master	-----	1000	1306	2400
		Before	-----	1000	1316	2400
		Before-Master	-----	-100	10	100

HDRS Density Calibration - Crystal Quality Resolutions

Master (EEPROM): 13:16:00 11-Dec-2011 Before (Measured): 17:14:01 20-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
BS Crystal Resolution	%	Master	----	5.00	10.76	25.00
		Before	----	5.00	10.81	25.00
		Before-Master	----	-1.00	0.05	1.00
SS Crystal Resolution	%	Master	-----	5.00	9.54	20.00
		Before	-----	5.00	9.28	20.00
		Before-Master	-----	-1.00	-0.26	1.00
LS Crystal Resolution	%	Master	----	5.00	8.18	20.00
		Before	----	5.00	8.23	20.00
		Before-Master	----	-1.00	0.05	1.00

HDRS MCFL Calibration - MCFL Accumulations

HDNS MSPE Calibration - MSPE Accumulations

Before (Measured): 17:04:10 20-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Main Resistivity	ohm.m	Before	3875	3565	3863	4185
Deep Resistivity	ohm.m	Before	3830	3524	3816	4136
Shallow Resistivity	ohm.m	Before	3830	3524	3824	4136

HGNS-B (HILT Gamma-Ray and Neutron Sonde, 125 degC) Calibration - Run 2

Primary Equipment :

HILT Gamma-Ray and Neutron Sonde, 125 degC	HGNS-B	1908

Auxiliary Equipment :

HGNS Accelerometer, 125 degC	HACCZ-B	709
AmBe Neutron Logging Source	NSR-F	2289

Calibration Parameter :

Water Temperature	
Housing Size	
JIG-BKG (Jig minus background reference)	165

HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured): 16:39:30 20-Dec-2011

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
AZ Vertical Measurement	ft/s2	Before	32.2	31.5	32.2	32.8

HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM): 00:00:00 15-Nov-2000

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Accelerometer Manufacturer		Master	-----	-----	Sunstrand	-----
Accelerometer Reference Temperature	degF	Master	-----	30.2	68.0	122.0
Accelerometer Coefficients - 0		Master	-----	-----	75.000	-----
Accelerometer Coefficients - 1		Master	-----	-----	-6.420	-----
Accelerometer Coefficients - 2		Master	-----	-----	0.028	-----
Accelerometer Coefficients - 3		Master	-----	-----	0.000	-----
Accelerometer Coefficients - 4		Master	-----	-----	2.164	-----
Accelerometer Coefficients - 5		Master	-----	-----	0.000	-----
Accelerometer Coefficients - 6		Master	-----	-----	0.000	-----
Accelerometer Coefficients - 7		Master	-----	-----	0.000	-----
Accelerometer Coefficients - 8		Master	-----	-----	297.600	-----
Accelerometer Coefficients - 9		Master	-----	-----	1.004	-----

HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM): 20:49:40 04-Oct-2011 Before (Measured): 17:06:35 20-Dec-2011 After:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
Near Zero Measurement	1/s	Master	0	5.0	26.9	40.0
		Before	0	5.0	27.1	40.0
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-4.0	0.2	4.0
		After-Before	-----	-----	-----	-----
Far Zero Measurement	1/s	Master	0	5.0	29.6	40.0
		Before	0	5.0	29.8	40.0
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-4.4	0.2	4.4
		After-Before	-----	-----	-----	-----
Near Plus Measurement - 0	1/s	Master	6031.0	4700.0	5807.0	6900.0
		Before	-----	-----	NOT DONE	-----
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	-----	-----
		After-Before	-----	-----	-----	-----
Far Plus Measurement - 0	1/s	Master	2793.0	1900.0	2445.0	2900.0
		Before	-----	-----	NOT DONE	-----
		After	-----	-----	NOT DONE	-----
		Before-Master	-----	-----	-----	-----
		After-Before	-----	-----	-----	-----
Near Corrected Plus Measurement - 0	1/s	Master		4700.0	5780.0	6900.0

		Before	-----	-----	-----	-----
		After	-----	-----	-----	-----
		Before-Master	-----	-----	-----	-----
		After-Before	-----	-----	-----	-----
Far Corrected Plus Measurement - 0	1/s	Master	-----	1900.0	2415.0	2900.0
		Before	-----	-----	-----	-----
		After	-----	-----	-----	-----
		Before-Master	-----	-----	-----	-----
		After-Before	-----	-----	-----	-----

HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured): 17:13:33 20-Dec-2011 After:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
RGR Zero Measurement	gAPI	Before	30.0	0	57.0	120.0
		After	----	-----	NOT DONE	-----
		After-Before	-----	-----	-----	-----
RGR Plus Measurement	gAPI	Before	185.4	157.1	162.2	206.3
		After	----	----	NOT DONE	----
		After-Before	----	----	----	----
GR Calibration Gain		Before	0.89	0.80	1.02	1.05
		After	-----	-----	-----	-----
		After-Before	-----	-----	-----	-----

LEH-QT (Logging Equipment Head - QT, 3-3/8 inch 31 pin HPHT with Tension Sensor) Calibration - Run 2

Primary Equipment :

Logging Equipment Head - QT, 3-3/8 inch 31 pin HPHT with Tension Sensor	LEH-QT	2776

HTEN Master Calibration - HTEN Master Calibration

Master:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
HTEN Shop Gain		Master	1.000	0.800	NOT DONE	1.200
HTEN Shop Offset	lbf	Master	0	-1000.000	NOT DONE	1000.000

HTEN Before Calibration - HTEN Before Calibration

Before:

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit
RHTE Zero Measurement - 0	lbf	Before	-----	-----	-----	-----
RHTE Plus Measurement - 0	lbf	Before	----	----	----	----
HTEN Gain - 0		Before	-----	-----	-----	-----
HTEN Offset - 0	lbf	Before	-----	-----	-----	-----

Company: Princeton Natural Gas, LLC

Schlumberger

Well: Citizen Green #1

Field: King Island Gas

County: San Juaquin

State: California

Platform Express

Array Induction / SP / GR / HSTS / MCFL

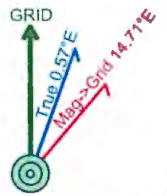
Density / Neutron

Job Number: 61011-2
Company: PRINCETON NATURAL GAS
Lease/Well: KING ISLAND/ citizen green # 1 P5
Location: N.CAL.
Rig Name: PG # 4
State/County: CALIFORNIA/ SAN JOAQUIN
Country: USA
API Number: 07720688

Elevation (To MSL): 0.00 ft
RKB: 11.00 ft
Projection System: US State Plane 1927 (Exact solution)
Projection Group: California III 403
Projection Datum: CLARKE 1866
Magnetic Declination: 14.14
Grid Convergence: -0.57096 W
Date: Sunday, December 18, 2011

West Coast Directional LLC
Casey Summitt 530-219-2591

Calculated by HawkEye Software
Minimum Curvature Method
Vertical Section Plane 121.06°
Northing: 577700.00 Easting: 1731570.00
Latitude: 38°04'58.6267" N Longitude: -121°25'57.4076" W
Direction Reference: Grid North



Measured Depth (Ft)	INC Deg	AZM Deg	TVD (Ft)	EW (Ft)	NS (Ft)	VS (Ft)	Closure (Ft)	DLS °/100Ft	Northing (Ft)	Easting (Ft)	Subsea TVD (Ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	577700.00	1731570.00	-11.00
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	577700.00	1731570.00	89.00
327.00	0.00	0.00	327.00	0.00	0.00	0.00	0.00	0.00	577700.00	1731570.00	316.00
554.00	2.20	188.90	553.94	-0.67	-4.30	1.64	4.36	0.97	577695.70	1731569.33	542.94
605.00	2.10	186.30	604.91	-0.93	-6.20	2.40	6.27	0.27	577693.80	1731569.07	593.91
655.00	2.10	159.20	654.88	-0.70	-7.97	3.51	8.00	1.97	577692.03	1731569.30	643.88
710.00	4.30	116.40	709.79	1.50	-9.83	6.36	9.94	5.65	577690.17	1731571.50	698.79
806.00	8.90	115.40	805.13	11.44	-14.61	17.34	18.56	4.79	577685.39	1731581.44	794.13
902.00	8.80	114.80	899.99	24.81	-20.88	32.03	32.43	0.14	577679.12	1731594.81	888.99
1003.00	8.80	116.70	999.80	38.73	-27.59	47.41	47.55	0.29	577672.41	1731608.73	988.80
1096.00	11.00	125.40	1091.41	52.32	-35.93	63.36	63.47	2.85	577664.07	1731622.32	1080.41
1191.00	13.70	125.40	1184.21	68.88	-47.70	83.61	83.78	2.84	577652.30	1731638.88	1173.21
1284.00	16.00	122.90	1274.10	88.62	-61.04	107.41	107.61	2.57	577638.96	1731658.62	1263.10
1380.00	18.50	125.10	1365.77	112.19	-76.99	135.83	136.07	2.69	577623.01	1731682.19	1354.77
1474.00	20.10	121.00	1454.49	138.24	-93.89	166.86	167.11	2.23	577606.11	1731708.24	1443.49
1569.00	23.60	121.70	1542.65	168.43	-112.29	202.21	202.43	3.69	577587.71	1731738.43	1531.65
1665.00	27.30	119.30	1629.32	203.99	-133.17	243.45	243.61	4.00	577566.83	1731773.99	1618.32
1760.00	30.50	119.30	1712.48	244.02	-155.64	289.33	289.43	3.37	577544.36	1731814.02	1701.48
1791.00	30.50	118.80	1739.19	257.77	-163.28	305.06	305.13	0.82	577536.72	1731827.77	1728.19
1887.00	31.90	120.50	1821.31	300.98	-187.89	354.77	354.81	1.72	577512.11	1731870.98	1810.31
2012.00	31.10	120.60	1927.89	357.23	-221.08	420.08	420.11	0.64	577478.92	1731927.23	1916.89
2136.00	30.40	120.40	2034.45	411.85	-253.26	483.47	483.49	0.57	577446.74	1731981.85	2023.45
2262.00	29.20	121.10	2143.79	465.67	-285.27	546.09	546.10	0.99	577414.73	1732035.67	2132.79
2358.00	30.50	122.30	2227.05	506.32	-310.39	593.86	593.88	1.49	577389.61	1732076.32	2216.05
2454.00	32.30	121.60	2308.99	548.76	-336.85	643.87	643.90	1.91	577363.15	1732118.76	2297.99
2579.00	32.20	122.10	2414.71	605.42	-372.05	710.57	710.60	0.23	577327.95	1732175.42	2403.71

Measured Depth (Ft)	INC Deg	AZM Deg	TVD (Ft)	EW (Ft)	NS (Ft)	VS (Ft)	Closure (Ft)	DLS °/100Ft	Northing (Ft)	Easting (Ft)	Subsea TVD (Ft)
2704.00	32.20	122.90	2520.48	661.59	-407.83	777.15	777.20	0.34	577292.17	1732231.59	2509.48
2799.00	32.50	121.90	2600.74	704.51	-435.07	827.97	828.02	0.65	577264.93	1732274.51	2589.74
2891.00	32.20	118.50	2678.46	747.04	-459.83	877.18	877.22	2.00	577240.17	1732317.04	2667.46
2983.00	32.90	118.60	2756.01	790.52	-483.49	926.63	926.65	0.76	577216.51	1732360.52	2745.01
3084.00	30.00	117.10	2842.17	837.09	-508.12	979.24	979.24	2.97	577191.88	1732407.09	2831.17
3213.00	30.20	117.10	2953.77	894.68	-537.60	1043.78	1043.78	0.16	577162.40	1732464.68	2942.77
3302.00	30.60	122.70	3030.55	933.68	-560.04	1088.76	1088.76	3.21	577139.96	1732503.68	3019.55
3394.00	30.90	122.20	3109.62	973.38	-585.27	1135.78	1135.78	0.43	577114.73	1732543.38	3098.62
3523.00	31.50	122.80	3219.96	1029.73	-621.18	1202.59	1202.59	0.52	577078.82	1732599.73	3208.96
3587.00	31.80	122.00	3274.44	1058.09	-639.17	1236.16	1236.16	0.81	577060.83	1732628.09	3263.44
3657.00	32.10	122.20	3333.84	1089.47	-658.86	1273.20	1273.20	0.45	577041.14	1732659.47	3322.84
3712.00	32.10	121.70	3380.43	1114.27	-674.33	1302.42	1302.42	0.48	577025.67	1732684.27	3369.43
3808.00	31.80	120.20	3461.89	1157.83	-700.45	1353.22	1353.22	0.88	576999.55	1732727.83	3450.89
3903.00	30.30	120.10	3543.27	1200.20	-725.06	1402.21	1402.21	1.58	576974.94	1732770.20	3532.27
3963.00	30.40	119.80	3595.05	1226.47	-740.20	1432.52	1432.52	0.30	576959.80	1732796.47	3584.05
4025.00	31.10	119.10	3648.33	1254.07	-755.78	1464.21	1464.21	1.27	576944.22	1732824.07	3637.33
4089.00	31.40	118.70	3703.05	1283.14	-771.83	1497.39	1497.39	0.57	576928.17	1732853.14	3692.05
4149.00	31.40	118.90	3754.26	1310.53	-786.89	1528.62	1528.62	0.17	576913.11	1732880.53	3743.26
4280.00	30.15	119.57	3866.81	1369.03	-819.62	1595.61	1595.62	0.99	576880.38	1732939.03	3855.81
4500.00	26.13	118.11	4060.77	1459.85	-869.73	1699.27	1699.29	1.85	576830.27	1733029.85	4049.77
4592.00	24.22	117.74	4144.03	1494.42	-888.06	1738.34	1738.37	2.08	576811.94	1733064.42	4133.03
4701.00	22.80	110.70	4243.99	1533.98	-905.93	1781.45	1781.52	2.88	576794.07	1733103.98	4232.99
4796.00	24.70	112.40	4330.95	1569.55	-920.01	1819.18	1819.31	2.13	576779.99	1733139.55	4319.95
4862.00	26.50	111.40	4390.47	1596.01	-930.63	1847.33	1847.52	2.80	576769.37	1733166.01	4379.47
4926.00	28.30	112.60	4447.28	1623.31	-941.68	1876.42	1876.67	2.94	576758.32	1733193.31	4436.28
5021.00	31.60	113.70	4529.59	1666.91	-960.34	1923.39	1923.75	3.52	576739.66	1733236.91	4518.59
5088.00	30.60	116.40	4586.96	1698.26	-974.98	1957.80	1958.23	2.56	576725.02	1733268.26	4575.96
5133.00	31.10	117.60	4625.59	1718.81	-985.46	1980.82	1981.27	1.76	576714.54	1733288.81	4614.59
5165.00	31.20	117.90	4652.98	1733.46	-993.16	1997.34	1997.82	0.58	576706.84	1733303.46	4641.98
5200.00	31.20	128.70	4682.94	1748.56	-1003.08	2015.39	2015.85	15.97	576696.92	1733318.56	4671.94
5300.00	29.70	128.60	4769.14	1788.14	-1034.73	2065.63	2065.94	1.50	576665.27	1733358.14	4758.14
5400.00	28.20	128.10	4856.65	1826.10	-1064.77	2113.64	2113.85	1.52	576635.23	1733396.10	4845.65
5410.00	28.20	128.60	4865.46	1829.80	-1067.70	2118.32	2118.53	2.36	576632.30	1733399.80	4854.46
5935.00	21.50	124.00	5341.62	2006.72	-1199.05	2337.65	2337.66	1.33	576500.95	1733576.72	5330.62
6430.00	17.30	119.37	5808.44	2146.13	-1285.91	2501.89	2501.89	0.90	576414.09	1733716.13	5797.44

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF PROPERTY AND WELL TRANSFER

Field or County		District
King Island Gas (San Joaquin Co.)		District 6
Former owner	Operator code	Date
Princeton Natural Gas, LLC	P4675	3/28/12

Name and location of well(s)
"CITIZEN GREEN" 1 (077-20688)
28/3N/5E

Description of the land upon which the well(s) is (are) located
Section 28, T3N, R5E, MD B& M, San Joaquin County, California

Date of transfer, sale, assignment, conveyance, or exchange	New owner	Operator code	Type of organization
3/26/12	Diversified Resources, LLC	D2412	
	Address: 647 Camino De Los Mares, Ste. 108 San Clemente, CA 92673		Telephone No.: (949) 698-4691

Reported by
Patrick Ross, Managing Member, Princeton Natural Gas

Confirmed by
Robert Montella, Managing Member, Diversified Resources, LLC

New operator new status (status abbreviation)	Request designation of agent
PI	Robert Montella Same as above.
Old operator new status (status abbreviation)	Remarks
PA	

Acting Deputy Supervisor: Michael L. Woods
Signature: Michael L Woods

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
AB – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book		
Form OGD140			Notice to be cancelled		
New well cards			Bond status		
Well records			EDP files		
Electric logs			Computer Files		
Production reports					

OGD156 (5/98)

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to:

March 26, 2012
(date)

Division of Oil, Gas, and Geothermal Resources
801 K Street
MS 20-22
Sacramento, California 95814-3530

Effective date of transfer / acquisition March 26, 2012 *(date)*, date of possession March 26, 2012 *(if different)*,

Princeton Natural Gas, LLC *(old operator)*, transferred

the following wells to Diversified Resources, LLC *(new operator)*

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec.	T.	R.	API Number
Citizen Green #1	King Island Gas Field	28	3N	5E	07720688

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: Section 28, T3N, R5E, MD B.& M., San Joaquin County, California

OLD OPERATOR

Princeton Natural Gas, LLC
(operator name)
34184 Pacific Coast Highway, Suite C
(address)
Dana Point, California 92629
Phone (858) 866 6962
By _____ 3/26/12
(signature) *(date)*
Patrick Ross — Managing Member
(printed name) *(title)*

NEW OPERATOR

Diversified Resources, LLC
(operator name)
647 Camino De Los Mares, Suite 108-127
(address)
San Clemente, California 92673
Phone (949) 698 4691
By _____ 3/26/12
(signature) *(date)*
montvision@cox.net
Robert Montella — Managing Member
(printed name) *(title)*

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

OG30A (10/03/UCP/1M)

STATE OF CALIFORNIA
RESOURCES AGENCY

DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

District 6

Please fill out the following questionnaire and return it promptly to this office.

Thank you for your cooperation.

District Deputy

Name of Operator Diversified Resources, LLC
(Exactly as will appear on all records filed with this Division)

Street Address of Head Office 647 Camino De Los Mares, Suite 108-127, San Clemente, California 92673
(Zip Code)

Mailing Address (if different from above)

Address of Production Accounting Office Same

Type of Organization LLC Phone 949.698.4691
(Corporation, Partnership, Individual, etc.)

Agent Robert D. Montella 647 Camino De Los Mares, Suite 108-127, San Clemente, California 92673
(Name) *(Address)*

949.698.4691
(Phone)

Engineer or Geologist Tom Fassio - Foothill Resources, Inc. 2628 Sherwood Drive, Salt Lake City, UT 84108
(Name) *(Address)*

CORPORATION

PARTNERSHIP
(List principal partners and their addresses)

President Managing Partner - Robert D. Montella

(Address, if other than head office)

Vice-president none

(Address)

Secretary-Treasurer none

(Address)

NOTE: Please let us know of any changes in names or addresses.

OGD7 (9/11)

2012 MAR 21 PM 4:08

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Operator Princeton Natural Gas, LLC Field King Island Gas County San Joaquin

Well Citizen Green #1 Sec. 28 T. 3N R. 5E MD B.&M.

A.P.I. No. 077-20688 Name Michael Phillips (Person submitting report) Title Consultant (President, Secretary, or Agent)

Date 2/6/12 (Month, day, year)

Signature

Address 34184 Pacific Coast Hwy Suite C, Dana Point CA 92629 Telephone Number 8588666962

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment, with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

Date

Princeton Natural Gas, LLC
Citizen Green #1
Drilling History

12/3/11 *MW/VIS/WL*	Paul Graham rig #6 on payroll @ 0:00 hrs. Mix mud. NU & test function test BOPE. Test blind rams to 1000 psi. MU 7 7/8" BHA & RIH. Test all BOPE - DOG waived witness. Tag cmt 429'. Drill cmt to 595'. POH. MU directional tools. DT 950'.
12/4/11 *10.0/44/6.0*	Circ & cond mud. DT 1231'. Pipe stuck - raise MW to 10.2# . Worked free. WH to shoe - 20k drag. DT 1294. WH to shoe. DT 1463'. WH to shoe. DT 1610'.
12/5/11 *10.3/46/5.0*	DT 1767'. WH 10 std - free. DT 1988'. WH 10 std - free. DT 2176'. WH 10 std - free. DT 2523'. WH 10 std - free. DT 2649'.
12/6/11 *10.2/43/5.2*	DT 2870'. WH 10 std - free. DT 3124'. WH 10 std - free. DT 3342'. WH to shoe - free. DT 3405'.
12/7/11 *10.2/40/4.9*	DT 3650'. WH 10 std - free. DT 4035'. WH 10 std - free. DT 4189'. Circ. RU lay down machine. LDDP.
12/8/11 *10.2/42/4.8*	LDDP. RU iron roughneck. PU NOV 5" core-thru DP. Stage in hole while PU DP. Circ @ 4189'
12/9/11 *10.2/39/5.2*	Core 4189-4249'. Retrieve core. Attempt to insert drill rod - NG. POH.
12/10/11 *10.3/42/4.9*	MU core tools. RIH to 4150' - circ BU. DT 4441'. Pipe stuck - worked pipe - full circulation. Retrieve drill rod.
12/11/11 *10.0/42/4.8*	RU & run free point. Pipe stuck 3100-3500'. Spot 30 bbl LVT pill. Wait 6 hours. Work pipe free. POH. Change BHA. RIH to shoe. Circ. Stage in hole.
12/12/11 *10.1/42/4.8*	DT 4532'. WH 6 std - free. DT 4659'. WH 9 std - free. DT 4733'. POH
12/13/11 *10.1/42/5.0*	MU directional tools. RIH. DT 4860'. Motor failed. POH. MU MM. RIH.
12/14/11 *10.1/42/5.0*	DT 5153'. WH 8 std - free. DT 5240'. Circ show. POH. MU new BHA.
12/15/11 *10.1/42/5.0*	RIH. DT 5246'. Take core 5246-5306'. Recover core. WH 5 std. DT 5533'. WH 9 std 40k drag.
12/16/11 *10.1/42/6.0*	DT 5781'. WH 10 std - free. DT 6062'. WH 10 std - free. DT 6187'.
12/17/11 *10.1/42/5.0*	DT 6311'. WH 10 std - free. DT 6561'. WH to 4994' - 40k drag. Work tight hole 5100' 5300' - 90k drag. Ream 5100' - 5430'.
12/18/11 *10.2/42/5.0*	DT 6779'. WH 20 std - 30k drag. DT 6973'. POH.
12/19/11 *10.2/42/5.0*	LD BHA. MU BHA. LD excess DP. RIH. Ream 6914-74'. DT 7274'.
12/20/11 *10.2/40/5.0*	DT 7336'. WH 10 std - free. DT 7570' - TD. WH 10 std - free. POH. RU Schlumberger. Run Platform Express.
12/21/11 *10.2/41/5.0*	RU & run CMR-HNGS. Stage in hole to TD. Circ clean POH.
12/22/11 *10.2/40/5.0*	POH. RU MDT tool. RIH. Unable to get below 520'. Made clean out run to 610'. Attempt to run MDT. Unable to get below 680'. LD tools. Stage in hole to TD. (ream 7480-7570) Circ clean. POH.
12/23/11	RU & RIH w/FMI tools. Run logs from 7460'. Make clean out run to 7514' - ream

10.2/40/5.0	7514'-7570'. Circ. POH.
12/24/11 *10.2/40/5.0*	POH. RU & RIH w/MSCT. POH. Recovered 43 cores. LD BHA. RIH OE.
12/25/11 *10/2/39/5.0*	RIH to 6016'. RU Thermasource. Equalize 300' cmt plug. POH 10 std - circ clean. POH. MU bit & RIH. Ream 5465-5525'. Circ clean. POH. LDDP.
12/26/11 *10.2/39/4.0*	LDDP. RU & run 133 jts 4 1/2" 11.6# N-80 LT&C csg equipped w/guide shoe @ 5513' and float collar @ 5469'. Centralizers 5' above shoe & on the next 29 joints. Circ clean. RU cementers. Cmt csg w/402 ft3 "Highbond" cmt @ 16#. Displace w/water. CIP 11:30 am. Land slips w/30,000# tension. ND BOPE. Cutoff csg. Land tbg hd. Clean pits. RR midnight.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Operator Princeton Natural Gas | Field King Island | County San Joaquin

Well Citzen Green #1 | Sec. 28 | T. 3N | R. 5E | MD B.&M.

A.P.I. No. 07720688 | Name Michael Phillips (Person submitting report) | Title Consultant (President, Secretary, or Agent)

Date 11/23/11 (Month, day, year)

Signature

Address PO Box 3034 Yuba City CA 95992 | Telephone Number 5306748121

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment, with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

Date	
8/30/11	MIRU Paul Graham drilling rig #3.
8/31/11	Found well w/1050 psi tbg 1800 psi csg. Held safety meeting - reviewed possible hazards - reviewed program. Circ well dead w/fresh water. Tear out tree NU BOPE. Test all BOPE. Measure tbg OOH. RIH OE to 4888'. Mix & equalize 25 sx neat cmt. POH 10 std reverse clean. SDFN 5 pm.
9/1/11	RIH & tag zone plug @ 4572' - DOG witnessed. Mud hole w/10# mud. Lay down excess tbg. Tear out BOPE. Weld pup & collar on 4 1/2" csg stub. RU wireline. RIH & attempt to establish free point. NG. Modify free point tool. Found casing free @ 720'. MU csg cutter & RIH. Cut csg @ 712'. Rig down wireline. LD 16 jts & cut offs. Install wellhead and tbg hangar. SDFN 7:30 pm.
9/2/11	Found well w/no pressure. RIH to 720' unable to work deeper. Pump 40 bbl mud before well circulated. Pumping 2 bpm at 0 psi - returns ~1/2 bpm. POH to 470' (in surface csg). Circulate at 2.5 bpm - returns ~ 1bpm. RIH to 718'. Mix & equalize 30 sx neat cmt. POH 150' - circ tbg clear. POH. Est top of cmt 580'. Shut down for weekend 1 pm.
9/7/11	Found well w/no pressure. RIH to 492'. Fill hole w/5 bbl fresh water - establish circ at 3.5 bpm - lost 2.5 bbl in 2 minutes. RIH to solid cmt @ 620'. Mix & equalize 55 sx neat cmt. POH to 410'. Reverse clean. POH. SDFN @ noon.
9/8/11	Found well w/no pressure. RIH tag plug @ 590'. Tally out of hole. RIH to 590'. Mix & equalize 50 sx neat cmt. POH to 400'. Clear tbg. POH. SDFN noon.
9/9/11	Found well w/no pressure. RIH to cmt @ 480'. Pressure csg to 1000 psi - bled to 0 psi in 30 seconds. Will hold 450 psi @ 1/2 bpm pump rate. Circ BU. Mix & equalize 15 sx neat cmt. POH SDFN @ noon. ETOC 430'.
9/12/11	Found well w/no pressure. RIH to solid cmt @ 433'. Test csg to 250 psi, 500 psi, 750 psi 5 minutes each. Test csg to 1000 psi for 15 min - good. LD tbg. Remove wellhead & confirm drift of 8 5/8" csg ~8". Secure well. Lay down rig.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

WELL SUMMARY REPORT

API NO. **077-20688**

Operator	Well				
Princeton Natural Gas, LLC	**Citizen Green #1**				
Field	County	Sec.	T.	R.	B.&M.
King Island Gas	**San Joaquin**	**28**	**3N**	**5E**	**MD**

Location (Give surface location from property or section corner, street center line)
2416' W & 1624' S of the NE corner of section 28

Elevation of ground above sea level
-6'

California Coordinates (if known): **577,700 & 1,731,570**

Was the well directionally drilled? ☒ Yes ☐ No If yes, show coordinates at total depth. **576,414 & 1,733,716 @ 6430' MD**

Commenced drilling (date)
12/3/11

Completed drilling (date)
12/20/11

Total depth: (1st hole) **7570'** (2nd) (3rd)

Depth measurements taken from top of:
☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing

Which is **12.0** feet above ground

Commenced production/injection (date)

Present effective depth **5366'**

Production mode: ☐ Flowing ☐ Pumping ☐ Gas lift

Junk
none

Name of production/injection zone(s)
Mokelumne

GEOLOGICAL MARKERS	DEPTH

Formation and age at total depth
Starkey - Cretaceous

Base of fresh water
~400'

	Clean Oil (bbl per day)	API Gravity (clean oil)	Percent Water (including emulsion)	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production						
Production After 30 days						

CASING AND CEMENTING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New (N) or Used (U)	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)	Top(s) of Cement in Annulus
8 5/8"	Surface	511'	24#	J-55/ST&C	N	12 1/4"	260 sx		surface
4 1/2"	Surface	5513'	11.6#	N-80/LT&C	N	7 7/8"	402 ft3		3700'

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforations, and method.)
N/A

Logs/surveys run? ☐ Yes ☐ No If yes, list type(s) and depth(s).
Mud Log 800-7570' **FMI 3600-7446'**
Platform Express 516-7554' **MSCT 4090-7424'**
CMR-NGRS 3600-7542' **SS 3600-7446'**

In compliance with Sec. 3215, Division 3, of the *Public Resources Code*, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name	Title	
Michael Phillips	**Consultant**	
Address	City/State	Zip Code
34184 Pacific Coast Hwy., Suite C	**Dana Point/CA**	**92629**
Telephone Number	Signature	Date
5306748121		**2/6/12**

OG100 (1/98/GSR/1M)
Printed on recycled paper.

SUBMIT IN DUPLICATE

NATURAL RESOURCE AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. T 611-263

REPORT ON OPERATIONS

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC.
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
September 14, 2011

Your operations at well **"Citizen Green" 1** API No.**077-20688**, Sec. **28** T.**3N**, R.**5E**, **M.D.**. B.&M., **King Island Gas** Field, in **San Joaquin** County, were witnessed on **9/1/11** by **Mary Kerr,** Energy and Mineral Resource Engineer, representative of the supervisor.

The operations were performed for the purpose of **abandonment of lower portion and redrill.**

Decision: **Approved**

Deficiencies noted and corrected: **None noted.**

Blanket Bond

Elena M. Miller
State Oil and Gas Supervisor

By B. A. Lackett
Michael L. Woods, District Deputy

MW/jc

OG109 - 9/2008

T611-243

DIV N OF OIL, GAS, AND GEOTHERMAL RESOURCE

CEMENTING/PLUGGING MEMO

Operator Princeton Natural Gas, LLC Well No. " Citizen Green" 1
API No. 077-20688 Sec. 28 T. 3N R. 5E , S.B. B&M
Field King Island Gas , County San Joaquin . On 9/1/2011 ,
~~Mr.~~ / Ms. Mary Kerr , representative of the supervisor, was present from 0830 to 0930 .

There were also present Mike Reed, Consultant, and Al Clinton,Toolpusher.

Casing record of well:

The operations were performed for the purpose of Abandonment of lower portion, and redrill.

☒ The plugging/cementing operations as witnessed and reported are approved.

☐ The location and hardness of the cement plug @ 8436' ' are approved.

Hole size: " fr. ' to ', " to ' & " to '

Casing				Cemented			Top of Fill		Squeezed Away	Final Pressure	Perforation
Size	Wt.	Top	Bottom	Date	MO-Depth	Volume	Annulus	Casing			

Casing/tubing recovered: " Shot/cut at ', ', ' Pulled fr. '
" Shot/cut at ', ', ' Pulled fr. '

Junk (in hole):

Hole fluid (bailed to) at '. Witnessed by

Mudding	Date	bbls	Displaced	Poured	Fill	Engineer

Cement Plugs		Placing	Placing Witnessed		Top Witnessed			
Date	Sx./cf	MO & Depth	Time	Engineer	Depth	Wt/Sample	Date & Time	Engineer
08/31/11	25sks/29CF	tbg@4888'	----------	Rpt'd	4572'	ATW	9/1/11 0840	MK

OGR10 (01/87)

ENTERED 8/17/11
BY:

From: Patrick Ross [mailto:princetonnaturalgas@yahoo.com]
Sent: Wednesday, August 17, 2011 7:41 AM
To: Woods, Mike
Subject: Citizen Green Well Survey

Good morning Mike,

We resurveyed the Citizen Green # 1 Well (formerly King Island 1-28, T-3N, R-5-E). . Please see the attached well coordinates and put in the well file.

Also, I plan to be in Sac today or tomorrow and wonder if I may stop in and meet you. Will give you a call this morning.

I would like a letter from the DOGGR officially acknowledging Princeton Natural Gas, LLC as Operator and as such, required by law to post the signs that Central Valley removed without notice to Princeton. Some language restraining Central Valley Gas Storage, LLC from further access to the Princeton wells would also be helpful.

Will call you to discuss.

Thanks

Pat Ross
858-866-6962

CITIZEN GREEN #1 Well COORDINATES

Ca State Plane, NAD '27, Zone 3: N = 577,700 E = 1,731,570 Elevation of ground adjacent to well = -6.7 (that's a minus elevation)
NAD '27 Lat = 38 04' 58.63" Long = 121 25' 57.41"
2,416' West and 1,624' South of the Northeast corner Projected Section 28, T3N, R5E, MDM.

Princeton Natural Gas, LLC

ATURAL RESOURCES AGENCY OF CALIFC IA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS AND GEOTHERMAL RESOURCES

No. P **611-238**

351 (Old) Field Code 351 (New)
00 (Old) Area Code 00 (New)
10 (Old) Pool Code 10 (New)

PERMIT TO CONDUCT WELL OPERATIONS

Patrick Ross, Agent
Princeton Natural Gas, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
May 17, 2011

Your proposal to **Rework and Redrill** well **"Citizen Green" 1**, A.P.I. No. **07720688**, Section **28**, T. **3N**, R **5E**, **MD** B. & M., **King Island Gas** Field, Area, **Mokelumne River** Pool, **San Joaquin** County, dated **5/5/2011**, received **5/9/2011** has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment, as defined by this Division's publication No. M07, shall be installed and maintained in operating condition and meet the following minimum requirements:
   a. Class **II 3M** on the **4 1/2"** casing during plugging operations.
   b. Class **III 2M** on the **8 5/8"** casing during redrilling operations.
   c. **3M lubricator** for **wireline** operations.

2. The **4 ½"** casing is cemented with sufficient cement to fill behind the casing to at least 500' above all oil, and gas zones and/or anomalous pressure intervals and to at least 100' above the base of freshwater zone.
3. Hole fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts shall be used.
4. All portions of the hole not plugged with cement are filled with inert mud fluid having a minimum density of **72** lbs./cu. ft and a minimum gel-strength (10 min.) of **20** lbs./100 sq. ft.
5. Water with any beneficial use is protected from contamination at all times.
6. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
7. The Division is promptly notified of any blowouts, fires, serious accidents, or any significant gas or water leaks.
8. No program changes are made without prior Division approval.
9. **THIS DIVISION SHALL BE NOTIFIED TO**:
   a. **Witness the location and hardness of the cement plug at 4672'.**
   b. **Witness** a test of the installed blowout prevention equipment on the **8 5/8"** casing prior to commencing redrilling operations. A test plug or packer will be needed in order to pressure test the BOPE. Prior to notifying the Division engineer to witness the test, the blind rams must be tested. Information on the blind rams test must be entered on the tour sheet along with the signature of the person in charge.

NOTE: The base of useable freshwater deposits should be encountered at a depth of approximately 400' +/-. A final determination must be made from the well logs after redrilling the well.

Blanket Bond
cc: Update

Waived BOPE 12/3/11 E. Reader

Elena M. Miller, State Oil and Gas Supervisor

Engineer: BG Tackett

Phone: (916) 322-1110

By Michael L. Woods
Michael L. Woods, District Deputy

A copy of this permit and the proposal must be posted at the well site prior to commencing operations. Records for work done under this permit are due within 60 days after the work is completed or the operations have been suspended. Issuance of this permit does not preclude the recipient from the obligation of being in compliance with all applicable Federal, State and Local laws, regulations and ordinances.

OG 111

From: Patrick Ross [mailto:princetonnaturalgas@yahoo.com]
Sent: Wednesday, August 17, 2011 7:41 AM
To: Woods, Mike
Subject: Citizen Green Well Survey

Good morning Mike,

We resurveyed the Citizen Green # 1 Well (formerly King Island 1-28, T-3N, R-5-E). . Please see the attached well coordinates and put in the well file.

Also, I plan to be in Sac today or tomorrow and wonder if I may stop in and meet you. Will give you a call this morning.

I would like a letter from the DOGGR officially acknowledging Princeton Natural Gas, LLC as Operator and as such, required by law to post the signs that Central Valley removed without notice to Princeton. Some language restraining Central Valley Gas Storage, LLC from further access to the Princeton wells would also be helpful.

Will call you to discuss.

Thanks

Pat Ross
858-866-6962

CITIZEN GREEN #1 Well COORDINATES

Ca State Plane, NAD '27, Zone 3: N = 577,700 E = 1,731,570 Elevation of ground adjacent to well = -6.7 (that's a minus elevation)
NAD '27 Lat = 38 04' 58.63" Long = 121 25' 57.41"
2,416' West and 1,624' South of the Northeast corner Projected Section 28, T3N, R5E, MDM.

Princeton Natural Gas, LLC

NATURAL RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

FOR DIVISION USE ONLY			
	Forms		
Bond	OGD114	OGD121	

NOTICE OF INTENTION TO REWORK / REDRILL WELL

Detailed instructions can be found at: www.conservation.ca.gov/dog/

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is ourintention to rework☐ / redrill ☒ well King Island 1-28 - to be renamed (Citizen Green #1) , API No. 07720688 ,
(Check one)

Sec. 28 ,T. 3 N ,R. 5E , MD B.&M., King Island Field, San Joaquin County.

The complete casing record of the well (present hole), including plugs and perforations, is as follows:(Attach wellbore schematics diagram also.)

8 5/8", 24#, J55 cemented at 511'.
4-1/2", 10.5#, J55, cemented at 4952'. TOC 3880'.
Perforations: 4 JHPF at 4772'-4775, Open

The total depth is: 4995 feet. The effective depth is: 4995 feet.

Present completion zone(s): Mokelumne River Sand . Anticipated completion zone(s): Mokelumne River Sand .
(Name) (Name)

Present zone pressure: 1600 psi. Anticipated/existing new zone pressure: 1600 psi.

Is this a critical well as defined in the California Code of Regulations, Title 14, Section 1720(a) (see next page)? Yes☐ No☒

For redrilling or deepening only, is a California Environmental Quality Act (CEQA) document required by a local agency? Yes☐ No☒ If yes, see next page.

The proposed work is as follows: (A complete program is preferred and may be attached.)

See attached Program

If well is to be redrilled or deepened, show proposed coordinates (from surface location) and true vertical depth at total depth: 2043 feet S (Direction) and 3392 feet E (Direction) Estimated true vertical depth: 8500'

Will the Field and/or Area change? Yes☐ No☒ If yes, specify New Field: New Area:

The Division must be notified immediately of changes to the proposed operations. Failure to provide a true and accurate representation of the well and proposed operations may cause rescission of the permit.

Name of Operator			
Princeton Natural Gas, LLC			
Address		City/State	Zip Code
34184 PCH Suite C		Dana Point CA	92629
Name of Person Filing Notice	Telephone Number:	Signature	Date
Patrick Ross	858-602-2916		7-8-11
Individual to contact for technical questions:	Telephone Number:	E-Mail Address:	
Patrick Ross	858-602-2916	Princetonnaturalgas@yahoo.com	

This notice and an indemnity or cash bond must be filed, and approval given, before the workover begins. (See the reverse side for bonding information.) If operations have not commenced within one year of the Division's receipt of the notice, this notice will be considered cancelled.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF CORRECTION OR CANCELLATION

Sacramento, California
July 22, 2011

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, Ca 92629

In accordance with **Section 3203 of the Public Resources Code**

the following change pertaining to your well **"King Island" 1-28 (API #077-20688)** ,

King Island Gas field, **San Joaquin** County,

Sec. **28** , T. **3N** , R. **5E** , **M.D.** B. &M., is being made to our records:

X **The name has been changed to "Citizen Green" 1 .**

☐ The corrected elevation is _____

☐ Report No. _____ , dated _____ , has been corrected as follows: _____

☐ Your notice to _____ dated _____ ,
(Drill, abandon, etc.)
and our report P# _____, issued in answer thereto, are hereby cancelled, in-as-much as the work was not done within one year of issuance of the permit. If you have an individual bond on file covering this notice, it will be returned. No request for such return is necessary.

☐ Other: _____

Elena M. Miller
State Oil and Gas Supervisor

Original signed by M.L. Woods:
By _____
Michael L. Woods
District Deputy

MW/jc

OG165

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REQUEST FOR CHANGE OF WELL DESIGNATION

July 21, 2011
Date

This is a request for a change of well designation for the following well(s):

Sec. 28 , T. 3N , R. 5E , MD B. & M., King Island Gas field,

Joaquin County.

OLD DESIGNATION	(API No.)	NEW DESIGNATION
King Island 1-28	07720688	Citizen Green # 1

Princeton Natural Gas, LLC
(Operator)

Patrick Ross
(Agent)

858.866.6962
(Phone)

princetonnaturalgas@yahoo.com
(E-mail)

34184 Pacific Coast Highway Suite C

Dana Point, California 92629
(Address)

(Signature)

Patrick Ross
(Printed Name)

OG16 (1/07)

NATURAL RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS AND GEOTHERMAL RESOURCES

No. P **611-238**

351 (Old) Field Code 351 (New)
00 (Old) Area Code 00 (New)
10 (Old) Pool Code 10 (New)

PERMIT TO CONDUCT WELL OPERATIONS

Patrick Ross, Agent
Princeton Natural Gas, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
May 17, 2011

Your proposal to **Rework and Redrill** well **"King Island" 1-28**, A.P.I. No. **07720688**, Section **28**, T. **3N**, R **5E**, **MD** B. & M., **King Island Gas** Field, Area, **Mokelumne River** Pool, **San Joaquin** County, dated **5/5/2011**, received **5/9/2011** has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment, as defined by this Division's publication No. M07, shall be installed and maintained in operating condition and meet the following minimum requirements:
   a. Class **II 3M** on the **4 1/2"** casing during plugging operations.
   b. Class **III 2M** on the **8 5/8"** casing during redrilling operations.
   c. **3M lubricator** for **wireline** operations.

2. The **4 ½"** casing is cemented with sufficient cement to fill behind the casing to at least 500' above all oil, and gas zones and/or anomalous pressure intervals and to at least 100' above the base of freshwater zone.
3. Hole fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts shall be used.
4. All portions of the hole not plugged with cement are filled with inert mud fluid having a minimum density of **72** lbs./cu. ft and a minimum gel-strength (10 min.) of **20** lbs./100 sq. ft.
5. Water with any beneficial use is protected from contamination at all times.
6. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
7. The Division is promptly notified of any blowouts, fires, serious accidents, or any significant gas or water leaks.
8. No program changes are made without prior Division approval.
9. **THIS DIVISION SHALL BE NOTIFIED TO**:
   a. Witness the location and hardness of the cement plug at 4672,,.
   b. Witness a test of the installed blowout prevention equipment on the **8 5/8"** casing prior to commencing redrilling operations. Prior to notifying the Division engineer to witness the test, the blind rams must be tested. Information on the blind rams test must be entered on the tour sheet along with the signature of the person in charge.

NOTE: The base of useable freshwater deposits should be encountered at a depth of approximately 400' +/-. A final determination must be made from the well logs after redrilling the well.

Blanket Bond
cc: Update

Elena M. Miller, State Oil and Gas Supervisor

Engineer: J. Truschel

Phone: (916) 322-1110

By Original Signed by
Michael L. Woods, District Deputy

A copy of this permit and the proposal must be posted at the well site prior to commencing operations. Records for work done under this permit are due within 60 days after the work is completed or the operations have been suspended. Issuance of this permit does not preclude the recipient from the obligation of being in compliance with all applicable Federal, State and Local laws, regulations and ordinances.

OG 111

INFORMATION FOR COMPLIANCE WITH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT OF 1970 (CEQA)

If an environmental document has been prepared by the lead agency, submit a copy of the ***Notice of Determination*** or ***Notice of Exemption***with this notice.Please note that a CEQA determination by a local jurisdiction, if required, must be complete, or the Division may not issue a permit.

CRITICAL WELL DEFINITION

As defined in the California Code of Regulations, Title 14, Section 1720 (a), "Critical well" means a well within:

(1) 300 feet of the following:
  (A) Any building intended for human occupancy that is not necessary to the operation of the well; or
  (B) Any airport runway.
(2) 100 feet of the following:
  (A) Any dedicated public street, highway or the nearest rail of an operating railway that is in general use;
  (B) Any navigable body of water or watercourse perennially covered by water;
  (C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground or any other area of periodic high-density population; or
  (D) Any officially recognized wildlife preserve.

WELL OPERATIONS REQUIRING BONDING

1. Drilling, redrilling, or deepening any well.
2. Milling out or removing a casing or liner.
3. Running and cementing casing or tubing.
4. Running and cementing liners and inner liners.
5. Perforating casing in a previously unperforated interval for production, injection, testing, observation, or cementing purposes.
6. Drilling out any type of permanent plug.
7. Reentering an abandoned well having no bond.

This form may be printed from the DOGGR website at www.conservation.ca.gov/dog/

NATURAL RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

FOR DIVISION USE ONLY			
	Forms		
Bond	OGD114	OGD121	
PB			

NOTICE OF INTENTION TO REWORK / REDRILL WELL

Detailed instructions can be found at: www.conservation.ca.gov/dog/

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to

rework☐ / redrill ☒ well King Island 1-28 , API No. 07720688 ,
(Check one)

Sec. 28 ,T. 3 N ,R. 5E , MD B.&M., King Island Field, San Joaquin County.

The complete casing record of the well (present hole), including plugs and perforations, is as follows: (Attach wellbore schematics diagram also.)

8 5/8", 24#, J55 cemented at 511'.
4-1/2", 10.5#, J55, cemented at 4952'. TOC 3880'.
Perforations: 4 JHPF at 4772'-4775, Open

The total depth is: 4995 feet. The effective depth is: 4995 feet.

Present completion zone(s): Mokelumne River Sand (Name). Anticipated completion zone(s): Mokelumne River Sand (Name).

Present zone pressure: 1600 psi. Anticipated/existing new zone pressure: 1600 psi.

Is this a critical well as defined in the California Code of Regulations, Title 14, Section 1720(a) (see next page)? Yes☐ No☒

For redrilling or deepening only, is a California Environmental Quality Act (CEQA) document required by a local agency? Yes☐ No☒ If yes, see next page.

The proposed work is as follows: (A complete program is preferred and may be attached.)

See attached Program

If well is to be redrilled or deepened, show proposed coordinates (from surface location) and true vertical depth at total depth: 1071 feet S (Direction) and 1630 feet E (Direction). Estimated true vertical depth: 5000'

Will the Field and/or Area change? Yes☐ No☒ If yes, specify New Field: New Area:

The Division must be notified immediately of changes to the proposed operations. Failure to provide a true and accurate representation of the well and proposed operations may cause rescission of the permit.

Name of Operator			
Princeton Natural Gas, LLC			
Address: 34184 PCH Suite C		City/State: Dana Point CA	Zip Code: 92629
Name of Person Filing Notice: Patrick Ross	Telephone Number: 858-602-2916	Signature	Date: 5-5-2011
Individual to contact for technical questions: Patrick Ross	Telephone Number: 858-602-2916	E-Mail Address: Princetonnaturalgas@yahoo.com	

This notice and an indemnity or cash bond must be filed, and approval given, before the workover begins. (See the reverse side for bonding information.) If operations have not commenced within one year of the Division's receipt of the notice, this notice will be considered cancelled.

OG107 (1/09)

Citizen Green #1 (King Island 1-28) Re-Drill Program

7/7/11

1. Move in rig. Kill well with 72 pcf mud. Install Class III BOP and test. DOGGR to witness.
2. Hang open ended tubing @ 4778'. Equalize 25 sx class G cement at 4778'. Locate top of cement at 4672' or above. Notify DOGGR to witness location and hardness of plug.
3. Cut and pull 4-1/2" casing from about 2500'+/- or as deep as possible.
4. Equalize 100 sx cement from 900'+/- for kick off plug.
5. Directionally drill 7-7/8" hole to 8500' TVD.
6. Run logs and complete if warranted.
7. Set 4-1/2" casing 200' below deepest pay cement 500' above highest pay zone.

King Island 1-28 Re-Drill Program 5-5-2011

1. Move in rig. Kill well with 72 pcf mud. Install Class III BOP and test. DOGGR to witness.
2. Hang open ended tubing @ 4778'. Equalize 25 sx class G cement at 4778'. Locate top of cement at 4672' or above. Notify DOGGR to witness location and hardness of plug.
3. Cut and pull 4-1/2" casing from about 2500'+/- or as deep as possible.
4. Equalize 100 sx cement from 900'+/- for kick off plug.
5. Directionally drill 7-7/8" hole to 5000' TD.
6. Run logs and complete if warranted.
7. Set 4-1/2" 10.5#, J55 casing to TD and cement.

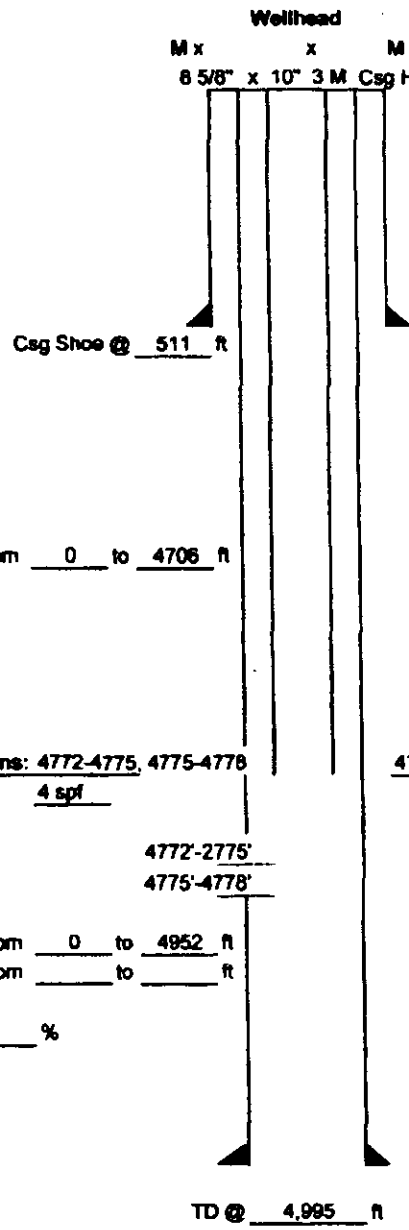
RECEIVED
2011 MAY -9 PM 1:55

WELLBORE SCHEMATIC

Well Name: King Island 1-28 **Spud Date:** 21-Jul-05 **Rig Release Date:** 27-Jul-05
API # : 04-077-20688

FILL IN ALL BLANKS ON FORM

Wellhead
M x x M Spool
8 5/8" x 10" 3 M Csg Head



Surface Casing

Size	8.625	in
Set at	511	ft
Wt.	24	ppf Grade J-55
Hole Size	12.25	in
Wash Out		%
Est. T.O.C.	0	ft

Csg Shoe @ 511 ft

Cement
Lead : 125 sxs, Class G
+ 3% CaCl + 6% Gel
Tail : 75 sxs, Class G
+ 3% CaCL, 60' top job

Shoe Test: N/A EMW
W.O.C. for 19 hrs (plug bump to drlg cmt)

Production Tubing

Size	2 3/8	in
Wt.	4.7	ppf
Type	EUE	ppf

[ ] New
[X] Used
Grade J-55 from 0 to 4706 ft

Perforations: 4772-4775, 4775-4778
4 spf

4706' End of Tubing

4772'-2775'
4775'-4778'

Production Casing

Size	4.5	in
Wt.	10.5	ppf
Wt.	N/A	ppf
PBTD	4135	ft (top of Float Collar)
Hole Size	7.875	in
Est. T.O.C.	870	ft
Marker Jt. Top	4740	ft

[x] New
[ ] Used
Grade J-55 from 0 to 4952 ft
Grade from to ft
Wash Out: %
Length: ft

Csg Shoe @ 4952 ft

Cement
Lead :
Tail : 150 sxs Class G
+ 3% CaCl2, 0.76% CFR-3, 0.10%CBL

Displacement Fluid: 76 Bbl Fresh H20
Pre Flush: 15 Bbl mud

Mud Wt. = 10 ppg @ TD

TD @ 4,995 ft

Drawn by:

CENTRALIZER LOCATION:

Surface:	15ft up	Total:	1
Intermediate:		Total:	
Production:	Top of 2nd, 3rd, 4th, 5th, 6th, joints, Flag joint at 4740'.	Total:	5

2011 MAY -9 PM 1:55

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF PROPERTY AND WELL TRANSFER

Field or County		District
King Island Gas (San Joaquin Co.)		**District 6**
Former owner	Operator code	Date
SOURCE ENERGY CORPORATION	**S4561**	**February 27, 2008**

Name and location of well(s)
"KING ISLAND" 1-28 (077-20688)
28/3N/5E

Description of the land upon which the well(s) is (are) located **A portion of Section 28, T3N, R5E San Joaquin County, CA**

Date of transfer, sale, assignment, conveyance, or exchange	New owner	Operator code	Type of organization
2/27/08	**Princeton Natural Gas, LLC**	**P4675**	
	Address **34184 PCH, Ste., C** **Dana Point, CA 92629**		Telephone No. **(858) 775-9897**

Reported by
James Frimodig, President, Source Energy Corporation

Confirmed by
Patrick Ross, President, Princeton Natural Gas, LLC

New operator new status (status abbreviation)	Request designation of agent
PA	**Patrick Ross** **Same as above.**
Old operator new status (status abbreviation) **PA**	Remarks

Deputy Supervisor
Robert S. Habel

Signature
Robert S Habel

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
AB – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book	RSH	2-27-08
Form OGD140			Notice to be cancelled		
New well cards			Bond status	RSH	2-27-08
Well records			EDP files	RSH	2-27-08
Electric logs			Computer Files	RSH	2-27-08
Production reports	RSH				

OGD156 (5/98)

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to: 2-11-08 (date)

Division of Oil, Gas, and Geothermal Resources
801 K Street 20th Floor
MS 20-20
Sacramento, California

Effective date of transfer / acquisition 2 /1/08 (date), date of possession 2/1/08 (if different),

Source Energy Corp. (old operator), transferred

the following wells to Princeton Natural Gas, LLC (new operator)

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec.	T.	R.	API Number
King Island 28-1 Well	King Island	28	3-N	5-E	07720668
I		07720688			

OIL-GAS-GEOTH RES
RECEIVED-SACRAMENTO
2008 FEB 27 AM 8:59

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: A portion of Section 28 T-3-N ,R-5-E San Joaquin County, CA

OLD OPERATOR	NEW OPERATOR
Source Energy Corp (54561) (operator name)	Princeton Natural Gas, LLC (PA675) (operator name)
3555 Santoro Way Suite A (address)	34184 PCH Suite "C" (address)
San Diego CA 92130	Dana Point, California 92629
Phone (858) 259-2271	Phone (858) 775-9897
By James Frimodig (signature) 2/19/08 (date)	By [signature] (signature) 2-11-08 (date)
James Frimodig (printed name) President (title)	Patrick Ross (printed name) President (title)

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

OG30A (10/03/UCP/1M)

DISTRICT 6 - WELL RECORDS CHECKLIST

API# 077-20688

WELL ID: "King Island" 1-28

NOTICE FOR: ____drill ____ abd ✓ rw ____rd

P numbers 605-434 & _____

RECORDS RECEIVED	Date Rec'd	Records ok	Copies in box for IHS	NORD	121 Entry	Remarks	Electronic	Posted on R
Well Summary (OG100)								
History (OG103)	12-2-05	✓	✓					
Directional Survey								
E-logs (2")								
E-logs (5")								
MUD Logs								
CBL								
Other								

____ **CONFIDENTIAL**

RELEASE DATE _____

ABANDONMENT

____ NEEDS Surface Inspection

STATUS *Mapped/DB*

Producing-gas	____	____
Idle-gas	____	____
Abandoned-gas	____	____
Drilling-Idle	____	____
Abandoned-dry hole	____	____
Water Disposal	____	____
Other _____		____

No change____

Date Completed _____

MAP MADE for Surface Inspection _____

Surface Inspection COMPLETED by _____

DATE_____

_____ FINAL LETTER NEEDED

Final Letter completed by: _____ Date: _____

Remarks _____

BOND RELEASE _____

DATE _____

Database entry by:_____

MAP # _____

RECORDS APPROVED

BY: RSH DATE: 12-05-05

SUBMIT IN DUPLICATE

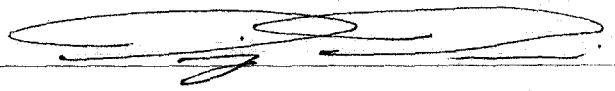
RESOURCES AGENCY OF CALIFORNIA

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 0 2 2005
Sacramento, California

OPERATOR	Source Energy, LLC	FIELD	King Island	COUNTY	San Joaquin
WELL	"King Island No. 1-28		SEC. 28 T 3N	R 5E	MD B.&M.
A.P.I. No	04-077-20688	NAME	Irani Engineering, Inc	TITLE	Petroleum Engineer
DATE	September 30, 2005		(PERSON SUBMITTING REPORT)		(PRES.,SECRETARY,or AGENT)

SIGNATURE: 

3555 Santoro Way Suite A, San Diego, CA 92130 — (ADRESS)

858-259-2271 — (TELEPHONE NUMBER)

History must be complete in all detail. Use this form to report all during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

Date	History
2005	
9-29	Found the well with 1700 psig SITP and 1840 psig SICP. Rigged up wireline. **Perforations at 4772'-4778':** United shot 4 Magnum JHPF with 1-1/16" through tubing perforator. Noted a fluid level at 4500'. There was no pressure increase after perforating. Released wireline unit.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 605-434

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
10 (new pool code)
10 (old pool code)

James P. Frimodig, Agent
SOURCE ENERGY CORP.
3555 Santoro Way, Suite A
San Diego, CA 92130

Sacramento, California
September 29, 2005

Your _____ proposal to Rework well "King Island" 1-28
A.P.I. No. 07720688, Section 28, 3N, R. 5E, MD B.&M.
King Island Gas field, Any Area area Mokelumne River pool
San Joaquin County, dated 9/29/05, received 9/29/05 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 3M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. **THIS DIVISION IS NOTIFIED:**
   a. Promptly, in the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks.
   b. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   c. To inspect the installed blowout prevention equipment prior to commencing operations.

Bond: 6-676

Hal Bopp, State Oil and Gas Supervisor
By Robert S. Habel
Robert S. Habel, Deputy Supervisor

Engineer Tim Kustic
Phone (916) 322-1110
TK/syh

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

NOTICE OF INTENTION TO REWORK / REDRILL WELL

C.E.Q.A. INFORMATION (when redrilling or deepening only)			
Exempt ☐	Neg. Dec. ☐	E.I.R. ☐	Document not required by local jurisdiction ☐
Class _____	S.C.H. No.	S.C.H. No.	
See Reverse Side			

FOR DIVISION USE ONLY			
	Forms		EDP Well
Bond	OGD114	OGD121	File
#6761	#4324		

This notice and an indemnity or cash bond must be filed, and approval given, before the rework/redrill begins. *(See the reverse side for bonding information.)* If operations have not commenced within one year of receipt of the notice, this notice will be considered canceled.

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework/redrill well "King Island" No. 1-28 API No. 04-077-20688
(Circle one) *(Well designation)*

Sec. 28 T. 3N R. 5E MD B.&M. King Island Gas Field

San Joaquin County.

1. The complete casing record of the well (present hole), including plugs and perforations, is as follows:
8-5/8", 24#, J-55, cemented at 511'.
4-1/2", 10.5#, J-55, cemented at 4952'.

Perforations: 4 JHPF at 4772'-4775'. Open

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SEP 29 2005
Sacramento, California

2. The total depth is: 4995 feet. The effective depth is: 4905 feet.

3. Present completion zone (s): Mokelumne *(Name)* Anticipated completion zone (s): Mokelumne *(Name)*

4. Present zone pressure: N/A psi. Anticipated/existing new zone pressure: N/A psi.

5. Last produced: NA *(Date)* _____ *(Oil, B/D)* _____ *(Water, B/D)* N/A *(Gas, Mcf/D)*

(or)
Last injected: _____ *(Date)* _____ *(Water, B/D)* _____ *(Gas, Mcf/D)* _____ *(Surface pressure, psig)*

6. Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

The proposed work is as follows: *(A complete program is preferred and may be attached.)*

Perforate 4 JHPF at 4772'-4778'.

For redrilling or deepening: _____ *(Proposed bottom-hole coordinates)* _____ *(Estimated true vertical depth)*

The division must be notified if changes to this plan become necessary.

Name of Operator	Telephone Number	
Source Energy Corporation	858-259-2271	
Address	**City**	**Zip Code**
3555 Santoro Way, Suite A	San Diego, CA	92130
Name of Person Filing Notice	**Signature**	**Date**
Irani Engineering, Inc.	[signature]	9/29/05

File in Duplicate

OG107 (7/97/GSR/5M)

DISTRICT 6 - WELL RECORDS CHECKLIST

API# 07-20688

WELL ID: _____

NOTICE FOR: X drill _____ abd _____ rw _____ rd

P numbers 605-434 & _____

RECORDS RECEIVED	Date Rec'd	Records ok	Copies in box for IHS	NORD	121 Entry	Remarks
Well Summary (OG100)	9/27/05	~	~			
History (OG103)	~	~	~			
Directional Survey						
E-logs (2")	10/2/08	~	~			
E-logs (5")	~	~	~			
MUD Logs	10/17/05	~	~			
CBL	~	~	~			
Other						

____ **CONFIDENTIAL**

RELEASE DATE _____

ABANDONMENT

_____ NEEDS Surface Inspection

STATUS *Mapped/DB*

Producing-gas	X	X
Idle-gas	____	____
Abandoned-gas	____	____
Drilling-Idle	____	____
Abandoned-dry hole	____	____
Water Disposal	____	____
Other _____		____

No change_____

Date Completed _____

MAP MADE for Surface Inspection _____

Surface Inspection COMPLETED by _____

DATE_____

_____ **FINAL LETTER NEEDED**

Final Letter completed by: _____ Date: _____

Remarks _____

BOND RELEASE _____

DATE _____

Database entry by: MFC

MAP # 610

RECORDS APPROVED

BY: MFC DATE: 11/16/06 O.K.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

WELL SUMMARY REPORT

API NO. **04-077-20688**

Operator	Well				
Source Energy Corp.	**"King Island" 1-28**				
Field	County	Sec.	T.	R.	B.&M.
King Island Gas	**San Joaquin**	**28**	**3N**	**5E**	**MD**

Location (Give surface location from property or section corner, street center line)
3,900' North and 2,380' West from the Southeast corner of section 28

Elevation of ground above sea level
-6'

California Coordinates (if known):

Was the well directionally drilled? ☐ Yes ☒ No If yes, show coordinates at total depth.

Commenced drilling (date)
7/21/05
Completed drilling (date)
7/28/05

Total depth: (1st hole) **4,995'** (2nd) (3rd)

Depth measurements taken from top of: ☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing
Which is **12'** feet above ground

Commenced production/injection (date)

Present effective depth **4,905'**

Production mode: ☐ Flowing ☐ Pumping ☐ Gas lift

Junk
None

Name of production/injection zone(s)

GEOLOGICAL MARKERS | DEPTH

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SEP 27 2005
Sacramento, California

Formation and age at total depth

Base of fresh water
400'

	Clean Oil (bbl per day)	API Gravity (clean oil)	Percent Water (including emulsion)	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production						
Production After 30 days						

CASING AND CEMENTING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New (N) or Used (U)	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)	Top(s) of Cement in Annulus
8-5/8"	Surface	511'	24.0#	J-55 / ST&C	N	12-1/4	260 sx	Shoe	Surface
4-1/2"	Surface	4,952'	10.5#	J-55 / ST&C	N	6-3/4"	150 sx	Shoe	3,880'

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforations, and method.)
4 JHPF @ 4,772'- 4,775'

Logs/surveys run? ☒ Yes ☐ No If yes, list type(s) and depth(s).
Mud log from 3,000'- 4,995', AIT/BHC Sonic/SP from 4,972'- 512', CBL/NL from 4,868'- 3,600'

In compliance with Sec. 3215, Division 3, of the *Public Resources Code*, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name	Title	
Source Energy Corp.	**Petroleum Engineer**	
Address	City/State	Zip Code
3555 Santoro Way, Suite A	**San Diego, California**	**92130**
Telephone Number	Signature	Date
(858) 259-2271		**9/20/05**

OG100 (1/98/GSR/1M)
Printed on recycled paper.

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Operator Source Energy Corp. Field King Island Gas County San Joaquin

Well "King Island" 1-28 Sec. 28 T. 3N R. 5E M.D. B.&M.

A.P.I. No. 04-077-20688 Name Irani Engineering (Person submitting report) Title Petroleum Engineer (President, Secretary, or Agent)

Date 9/20/05 (Month, day, year)

Signature

Address 3555 Santoro Way, Suite A, San Diego, CA 92130 Telephone Number (858) 259-2271

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment, with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

Div. of Oil & Gas - Dist. 6
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SEP 27 2005
Sacramento, California

Date
2005

7/21 MIRU Caza rig 503. Mixed spud mud. Installed conductor. Drilled 12-1/4" to 300'.

7/22 Drilled to 511'. Circulated clean and wiped hole to bit. POOH. Rigged up power tongs.
8-5/8" casing @ 511'. Ran 12 joints (514') of 8-5/8", 24#, J-55, ST&C new casing including guide shoe and insert. Cemented shoe at 511' with 125 sacks Class G cement with 6% gel and 3% CaCl2 followed with 75 sacks Class G cement with 3% CaCl2. Performed 60 sack cement top job. WOC. Cut off casing.

7/23 Welded casing head and tested it to 2,000 psi. Installed BOP. Function tested CSO to 1,500 psi. Made up BHA and RIH to 500'. Tested BOPE, witnessed and approved by DOG. Drilled out insert, cement and shoe. Circulated and conditioned mud. Drilled 6-3/4" hole to 1,140', mud weight 9.5 ppg.

7/24 Drilled to 3,301', mud weight 10.0 ppg. Surveyed at 1,817' and 2,807', drift angles 1° 00' and 2° 00'.

7/25 Drilled to 4,995', mud weight 10.0 ppg. Surveyed at 3,802' and 4,793', drift angles 1° 00' and 1° 00'. Irculated and wiped hole to shoe.

7/26 RIH, circulated and POOH for E log.
Schlumberger ran **AIT/BHC Sonic/SP** from **4,972'- 512'**. Made up BHA and RIH to 4,995'. Circulated hole clean and conditioned mud. Rigged up and laid down DP, HW's and BHA. Rigged up power tongs and ran casing.
4-1/2" casing @ 4,952'. Ran 122 joints of 4-1/2", 10.5#, J-55, ST&C new casing including PDF shoe, PDF collar at 4,905' and one flag joint. Placed 5 centralizers from top of second joint.

7/27 Rigged up Halliburton and cemented casing. Pumped 15 Bbl of mud flush ahead and cemented shoe at 4,952' with 150 sacks of Class G cement premixed with 3% CaCl2, 0.75% CFR-3, 0.15% Super CBL. Flushed line, dropped plug, displaced with water. CIP @ 03:40 am. Set casing slips. Nippled down BOP. Cut off casing. Nippled up and tested tubing spool to 3,000 psi. Cleaned mud pit. Released rig at 04:00 pm.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Operator Source Energy Corp. Field King Island Gas County San Joaquin
Well "King Island" 1-28 Sec. 28 T. 3N R. 5E M.D. B.&M.
A.P.I. No. 04-077-20688 Name Irani Engineering (Person submitting report) Title Petroleum Engineer (President, Secretary, or Agent)
Date 9/20/05 (Month, day, year)
Signature
Address 3555 Santoro Way, Suite A, San Diego, CA 92130 Telephone Number (858) 259-2271

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment, with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

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Sacramento, California

Date
2005

8/05 Moved in KDY rig #1. Picked up tubing to 4,605'. POOH to 2,104'. Secured rig.

8/08 POOH with tubing. R/U Halliburton.
Halliburton ran CBL/NL from 4,890'- 3,880'. Tagged bottom of the hole at 4,892'and TOC @ 3,880'.

Measured, drifted and ran in hole with 145 joints of 2-3/8", 4.7#, J-55 tubing. Landed tubing on hanger with tail at 4,706'. Installed production tree and tested it to 3,000 psig. Swabbed the well to 1,550'. Rigged up United Wireline.

United shot 4 Dynacap JHPF @ 4,772'- 4,775'. The well had a light blow and pressure. Unloaded the well through an adjustable choke and recovered 44 Bbl of load water. .

Flowed the well through a 1/8" positive choke. The well stabilized after 2 hours producing 455 Mcf/D gas with 1,330 psig tubing and 1,560 psig casing pressure.

No. T 605-106

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT ON OPERATIONS

District 6, (916) 322-1110

James P. Frimodig, Agent
SOURCE ENERGY CORP.
3555 Santoro Way, Suite A
San Diego, CA 92130

Sacramento, California
August 9, 2005

Your operations at "King Island" 1-28 **. API No.** 07720688
Sec. 28 **T.** 3N **R.** 5E MD **B. & M.** King Island Gas
field, in San Joaquin **County**
were witnessed on 7/23/05 **by** R. Loverne **representative of**
the supervisor, was present from 1315 **to** 1545
There was also present J. Lumsden, Co. Rep.
Present condition of the well: 8-5/8" cem 511'. TD 514'. (Drilling)

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION:
The blowout prevention equipment and its installation on the 8-5/8" casing are approved.

REMARKS AND DEFICIENCIES: 1) Leak @ accumulator- Status: repaired. 2) Unused hydraulic lines not capped - Status: repaired. 3) No standpipe pressure gauge – Status: repaired. 4) Target "T" installed wrong on kill-line – Status: Will repair. 5) Remote not hooked up – Status: repaired.
*Note – Tested blind rams to 1500 psi – logged on tour sheet.

BOND: Bond # 6-761
STATUS:

RSH/sdl

Hal Bopp
State Oil and Gas Supervisor

By Robert S Habel
Deputy Supervisor
Robert S. Habel

OG109 Rev9/01 **(9/89/GSR1/5M)**

API No. 077-20688 DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES T 605-106

BLOWOUT PREVENTION EQUIPMENT MEMO

Operator Source Energy Corp Well "Kings Island" 1-28 Sec. 28 T. 3N R. 5E
Field Kings Island Gas County San Joaquin Spud Date 7/22/05

VISITS:	Date	Engineer	Time	Operator's Rep.	Title
1st	7/23/05	R Laverne	(1315 to 1545)	J. Lumsden	Company man
2nd			(to)		

Contractor CAZA Rig # 503 Contractor's Rep. & Title Brian ~~Tool Pusher~~
Casing record of well: 8 5/8" cem 511'. TD 514' (Drilling).

OPERATION: Testing ~~(inspecting)~~ the blowout prevention equipment and installation. Critical well? Y ☒ N ☐
DECISION: The blowout prevention equipment and its installation on the 8 5/8" " casing are approved.

Proposed Well Opns: Drill New Well MACP: psi
Hole size: 12 1/4" fr. 0 ' to 514 ', " to ' & " to '

REQUIRED BOPE CLASS: IIIB 2M

CASING RECORD OF BOPE ANCHOR STRING					Cement Details	Top of Cement	
Size	Weight(s)	Grade(s)	Shoe at	CP at		Casing	Annulus
8 5/8"	24#	J-55	511'		Lead: 125 sx 144 cf	469'	0'
					Tail: 75 sx 86 cf		
					Top Job: 230 cf		

BOP STACK							TEST DATA						
API Symb.	Ram Size (in.)	Manufacturer	Model or Type	Vert. Bore Size (in.)	Press. Rtg.	Date Last Overhaul	Gal. to Close	Recov. Time (Min.)	Calc. GPM Output	psi Drop to Close	Secs. to Close	Test Date	Test Press.
A	CSO	?	?	11"	3M		12.0					7/23	800 psi
RA	4"	Shaffer	LWS	11"	3M		2.0					7/23	1000 psi
RA	CSO	Shaffer	LWS	11"	3M		2.0					—	—
							↓						
							TOTAL: 16.0						

ACTUATING SYSTEM
Accumulator Unit(s) Working Pressure 2800 psi
Total Rated Pump Output ____ gpm Fluid Level
Distance from Well Bore 75 ft. OK

	Accum. Manufacturer	Capacity	Precharge
1	Koomey	90 gal.	1000 psi
2		gal.	psi

CONTROL STATIONS	Elec.	Hyd.	Pneu.
☒ Manifold at accumulator unit		X	
☒ Remote at Driller's station			X
Other:			

EMERG. BACKUP SYSTEM			Press.	Wkg. Fluid
☒ N_2 Cylinders	1	L= 51 "	2700	9.0 gal.
Other:	2	L= 51 "	2700	9.0 gal.
	3	L= 51 "	2400	7.0 gal.
	4	L= "		gal.
	5	L= "		gal.
	6	L= "		gal.
		TOTAL:	25.0	ga

HOLE FLUID MONITORING	Alarm Type: Audible	Visual	Class
☒ Calibrated Mud Pit	X	X	A
☒ Pit Level Indicator	X	X	
☒ Pump Stroke Counter	X	X	B
☐ Pit Level Recorder			
☐ Flow Sensor			C
☐ Mud Totalizer			
☐ Calibrated Trip Tank			
☐ Other:			

AUXILIARY EQUIPMENT

		No.	Size (in.)	Rated Press.	Connections: Weld	Flange	Thread	Test Press.
X	Fill-up Line							
X	Kill Line		7"	2M	X	X	X	1000 psi
X	Control Valve(s)	1		2M		X		—
X	Check Valve(s)	2		2M			X	1000 psi
X	Aux. Pump Connect.			2M			X	
X	Choke Line		3"	2M	X	X	X	
X	Control Valve(s)	8		2M		X		
X	Pressure Gauge						X	
X	Adjustable Choke(s)	2	3"	2M		X		—
X	Bleed Line		3"		X	X	X	
X	Upper Kelly Cock							1500 psi
X	Lower Kelly Cock		4"	2M				
X	Standpipe Valve							
	Standpipe Press. Gau.							
X	Pipe Safety Valve		4"	2M				—
X	Internal Preventer		4"	2M				—

Hole Fluid Type	Weight	Storage Pits (Type & Size)
Mud	9.0 ppg	310 bbl.

REMARKS AND DEFICIENCIES:
1. Leak @ Accumulator. Repaired
2. Unused Hydraulic Lines not capped. Repaired
3. No Standpipe Pressure Gauge. Repaired
4. Target T Installed wrong on Kill Line. Will Repair
5. Remote not hooked up. Repaired.

Note: Tested Blind Rams to 1500 psi. Logged on Tour Sheet.

OGD9 (4/99)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 605-264

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)

Well Classification: Development

00 (area code)

10 (new pool code)

-- (old pool code)

James P. Frimodig, Agent
SOURCE ENERGY CORP.
3555 Santoro Way, Suite A
San Diego, CA 92130

Sacramento, California
June 20, 2005

Your _____ proposal to Drill well "King Island" 1-28
A.P.I. No. 07720688, Section 28, T. 3N, R. 5E, MDM. B.&M.
King Island Gas field, Any Area area Mokelumne River pool
San Joaquin County, dated 6/13/05, received 6/15/05 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing proposed to be set at 500' is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 4 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity is used to control all subsurface conditions to prevent blowouts.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. **THIS DIVISION IS NOTIFIED:**
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.
   c. Promptly, in the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks.

NOTE:

1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 400'±. A final determination must be made from the well logs after the well is drilled.

THIS WELL CANNOT BE DRILLED BELOW 4999 FEET WITHOUT ADDITIONAL BONDING AND APPROVAL FROM THIS OFFICE.

WHEN THE WELL HAS BEEN SPUDDED, PLEASE CONTACT THIS OFFICE DURING DAYLIGHT HOURS (8AM TO 5PM) AT (916) 322-1110.

Bond: 6-761 Enclosures (3)

Lat: 38.08361 Long: -121.43204
Engineer Tim Kustic
Phone (916) 322-1110
cc:
TK/syh

Hal Bopp, State Oil and Gas Supervisor
By Robert S Habel
Robert S. Habel, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

PA 050106

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

NOTICE OF INTENTION TO DRILL NEW WELL

C.E.Q.A. INFORMATION			
EXEMPT ☒ CLASS ____	NEG. DEC. ☐ S.C.H. NO. ____	E.I.R. ☐ S.C.H. NO. ____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☐
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
610	TR 6/17/05	264	6-761		

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well King Island 1-28, well type Gas, API No. 077-20698 (Assigned by Division),

Sec. 28, T. 3N, R.5E, M.D.B.&M., King Island Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 508 acres (attach map or plat to scale), is as follows:
APN 071-080-43

OG BPW Limit 400 Depth

Div. of Oil & Gas - Dist. 6
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Do mineral and surface leases coincide? Yes ☒ No ☐. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 3900 feet North (Direction) along section ☒ / property ☐ (Check one) line and 2380 feet West (Direction)

at right angles to said line from the Southeast corner of section ☒ / property ☐ (Check one) 28 or

38.08361
-121.43204

Is this a critical well according to the definition on the next page of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) and true vertical depth at total drilled depth: ____ feet ____ (Direction) and ____ feet ____ (Direction) Estimated true vertical depth ____. Elevation of ground above sea level ____ feet. All depth measurements taken from top of ____ (Derrick Floor, Rotary Table, or Kelly Bushing) that is ____ feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
8-5/8	24	J-55	Surface	500'	500'-Surface	500'
4-1/2	10.5	J-55	Surface	4999'	4999'-4300'	699'

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Mokelumne, 4650', 1800 pisa (Name, depth, and expected pressure) Estimated total depth 4999' (Feet)

It is understood that if changes to this plan become necessary, we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
Source Energy Corp.	Corporation	
Address: 3555 Santoro Way	City: San Diego	Zip Code: 92130
Telephone Number: (858) 259-2271 / Name of Person Filing Notice: James Frimodig	Signature: James Frimodig	Date: 6/13/2005

This notice and an indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

OG105 (5/98)

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: _____

Lead Agency Contact Person: _____

Address: _____

_____

Phone: ( ) _____

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks: _____
_____
_____

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720 (a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

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Description: San Joaquin, CA Assessor Map 71.8 Page: 1 of 1
Order: 05-75 Comment:

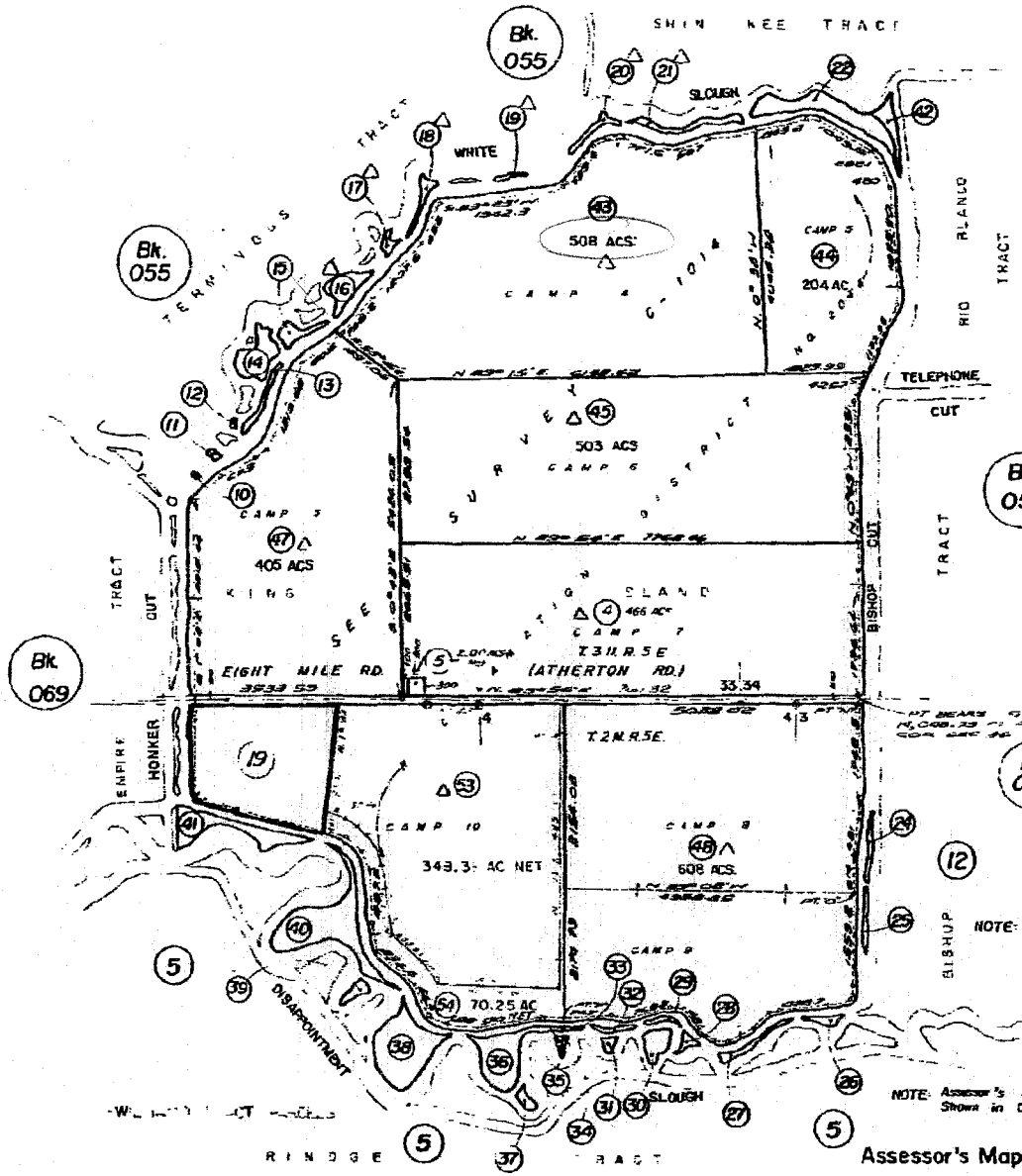
KING ISLAND

T. 2 N. R. 5 E. - T. 3 N. R. 5 E.

071-08

THIS MAP FOR ASSESSMENT USE ONLY

1"=2000'



NOTE: All Section Corners Are Approximate in Location

NOTE: Assessor's Parcel Numbers Shown in Circles.

Berm No.		Acres
10	-	0.2
11	-	0.5
12	-	0.4
13	-	2.2
14	-	9.1
15	-	2.5
16	-	6.3
17	-	1.6
18	-	2.1
19	-	0.4
20	-	2.6
21	-	3.4
22	-	8.1
24	-	1.7
25	-	0.6
26	-	1.1
27	-	2.0
28	-	0.9
29	-	0.4
30	-	3.1
31	-	1.0
32	-	0.5
33	-	0.3
34	-	0.4
35	-	0.8
36	-	13.9
37	-	1.5
38	-	21.3
39	-	1.6
40	-	22.6
41	-	14.2
42	-	2.6

Assessor's Map Bk. 071-Pg. 08

Div. of Oil & Gas - Dist. 6
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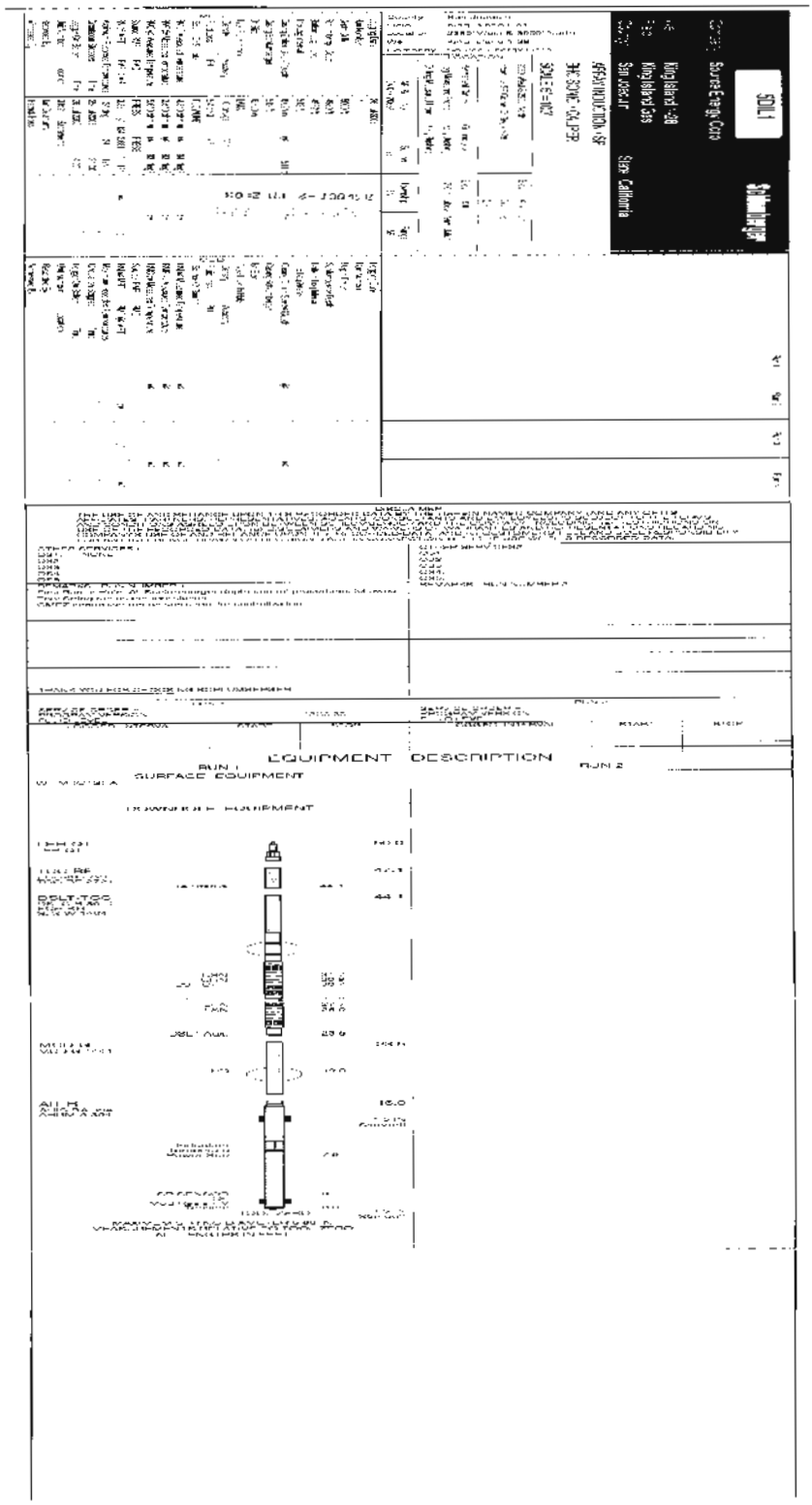
JUN 15 2005
Sacramento, California

JAN 26 1994



Schlumberger

MAIN LOG
5" = 100'

MAXIS Field Log

Input DLIS Files

DEFAULT	AIT SONIC 805LUP	FN:4	PRODUCER	26-Jul-2005 04:24	4990.0 FT	392.0 FT

Output DLIS Files

DEFAULT	AIT SONIC 812PUP	FN:11	PRODUCER	26-Jul-2005 06:13	4993.0 FT	500.0 FT

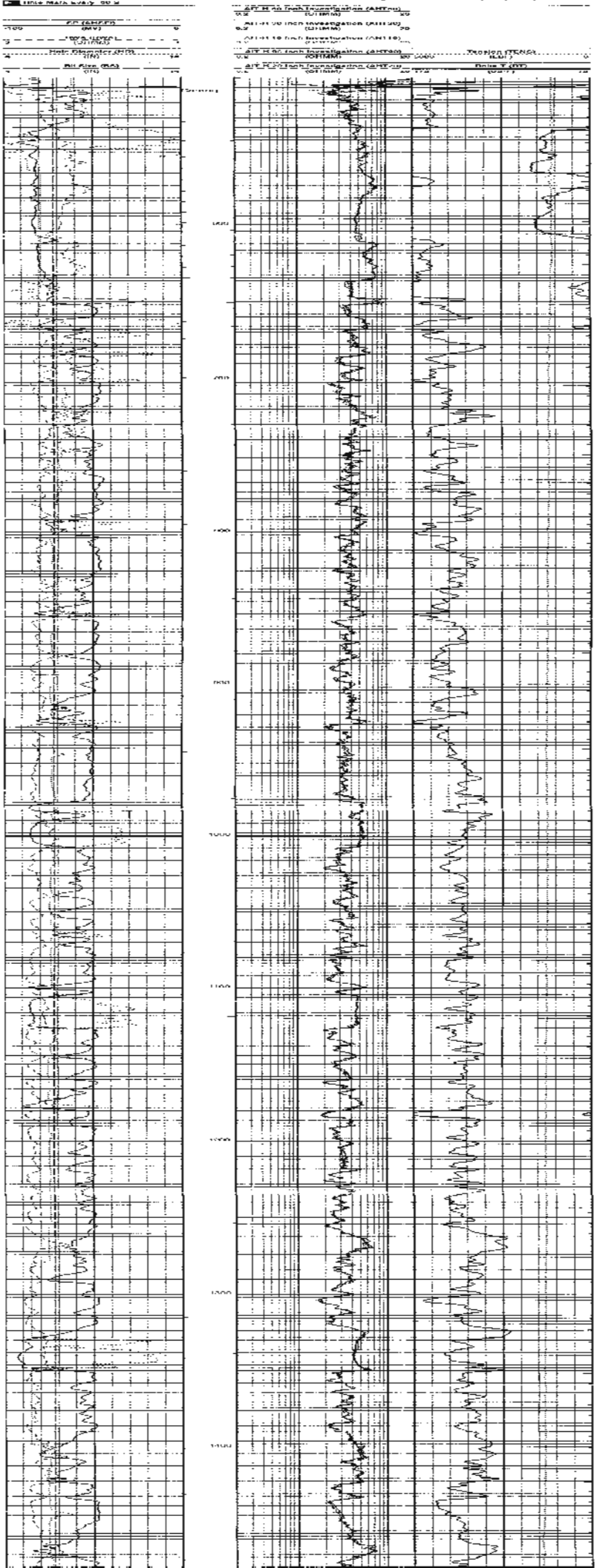
Integrated Hole/Cement Volume Summary

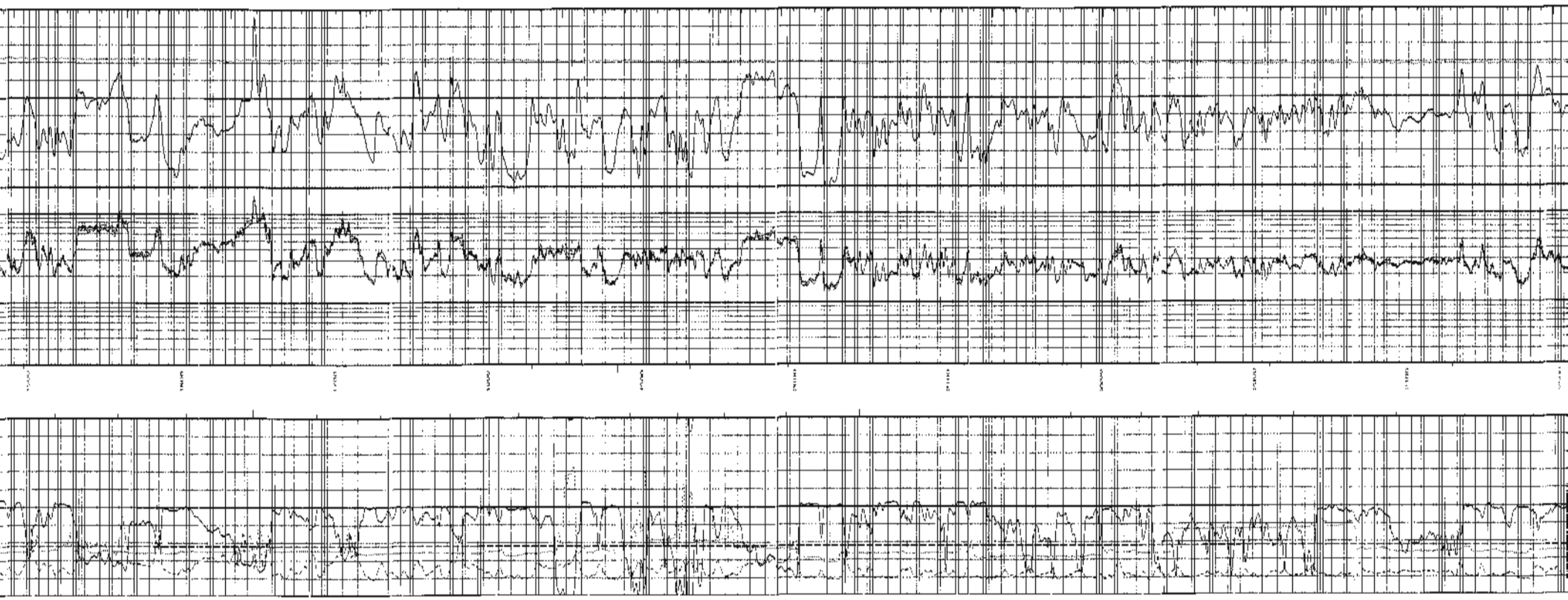
Hole Volume = 1236.61 F3
Cement Volume = 740.11 F3 (assuming 4.50 IN casing O.D.)
Computed from 4990.0 FT to 812.0 FT using data channel(s) HD

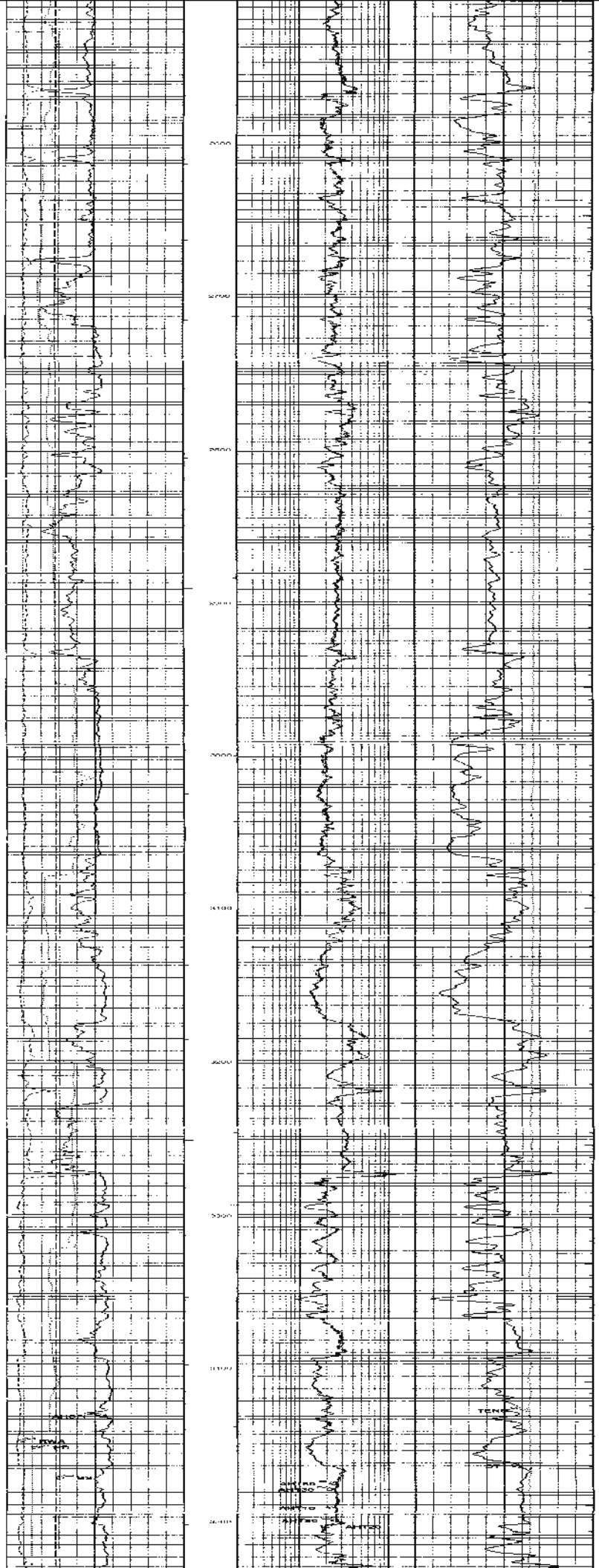
OP System Version: 12C0-301

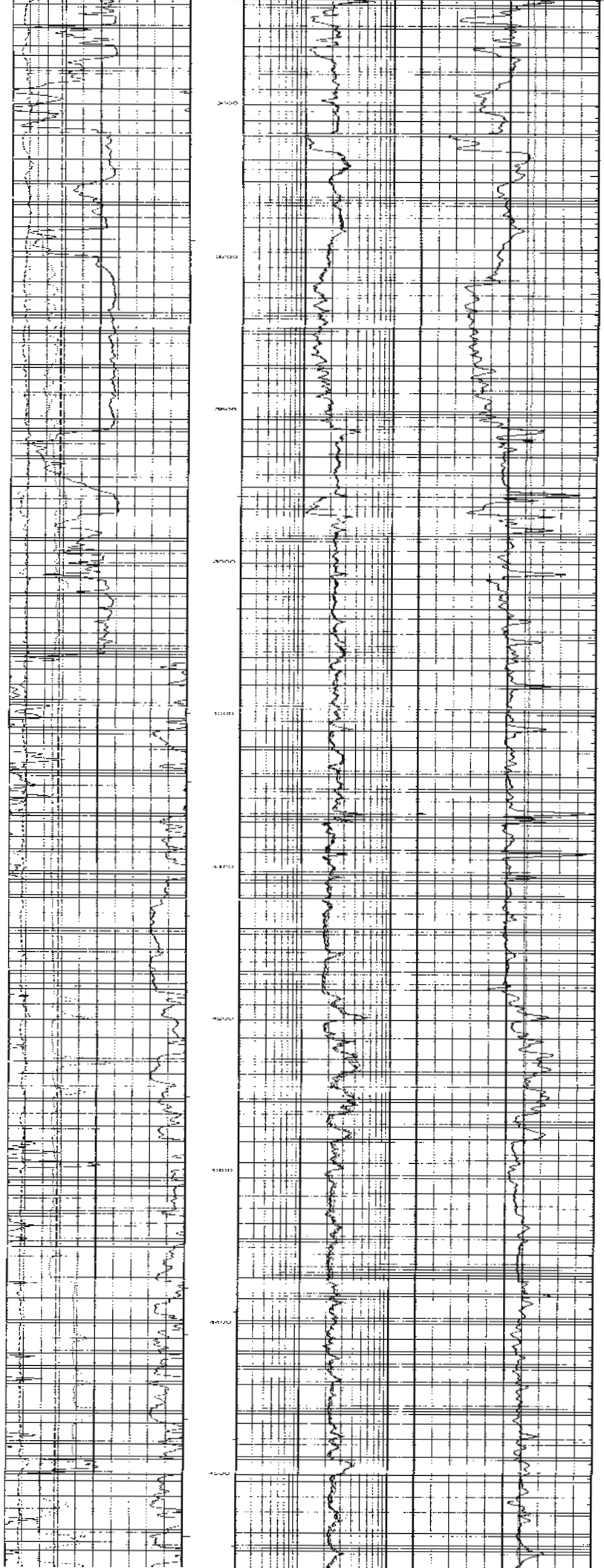
AIT H	12C0-301	MGD C	12C0-301
DSLT-TGC	12C0-301	TGC RF	12C0-301

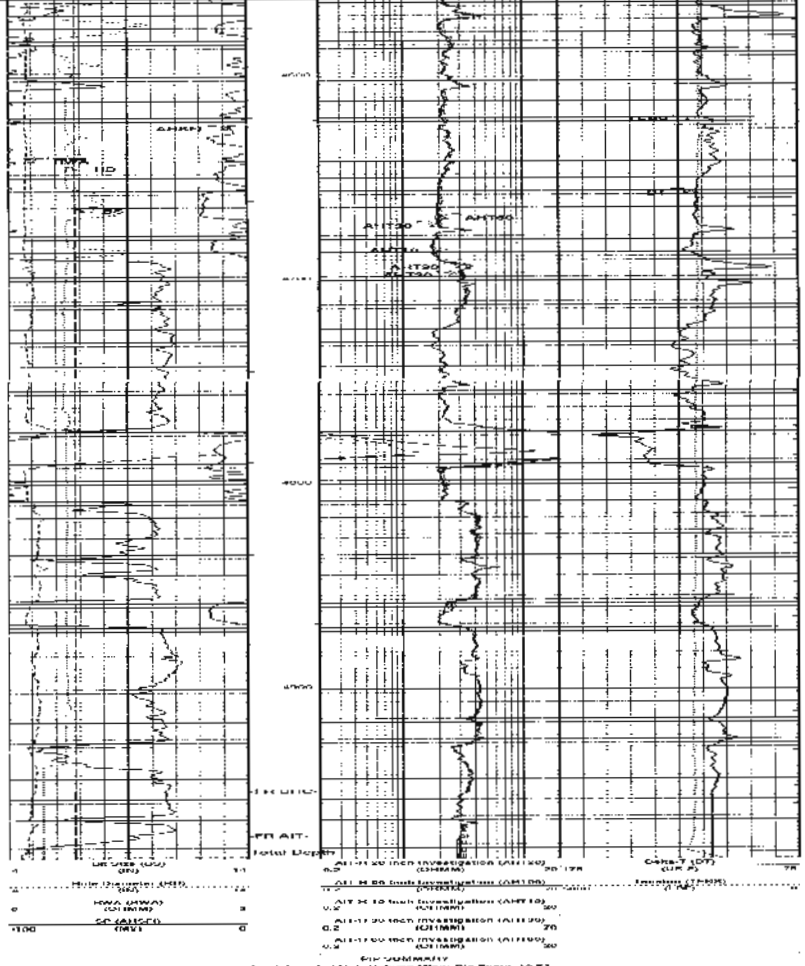
PIP SUMMARY
Integrated Hole Volume Minor Pip Every 10 F3
Integrated Hole Volume Major Pip Every 100 F3
Integrated Cement Volume Minor Pip Every 10 F3
Integrated Cement Volume Major Pip Every 100 F3
Integrated Transit Time Minor Pip Every 1 MS











Time Mark Every 60 S

Parameters

DLIS Name	Description	Value
[illegible]	[illegible]	[illegible]

Format 4INCH Vertical Scale: 5" per 100' Neptune File Created: [illegible]

OP System Version: 12C0-301

AIT-H	12C0-301	MCG-B	12C0-301
DSLT-TCC	12C0-301	TCC-AP	12C0-301

Input DLIS Files

DEFAULT	AIT_SONIC_[illegible]	FN-4	PRODUCER	28 Jul 2008 [illegible]	[illegible] FT

Output DLIS Files

DEFAULT	AIT_SONIC_[illegible]	FN-11	PRODUCER	28 Jul 2008 [illegible]	

Schlumberger REPEAT SECTION

MAXIS Field Log

Input DLIS Files

DEFAULT	AIT_SONIC_[illegible]	FN-3	PRODUCER	28 Jul 2008 [illegible]	[illegible] FT

Output DLIS Files

DEFAULT	AIT_SONIC_[illegible]	FN-10	PRODUCER	28 Jul 2008 [illegible]	[illegible] FT

Integrated Hole/Cement Volume Summary

Hole Volume 174.24 FT³
Cement Volume 183.33 FT³ (assuming 5.00 IN casing O.D.)
Computed from 719.0 FT to 512.0 FT using data channel(s) HD

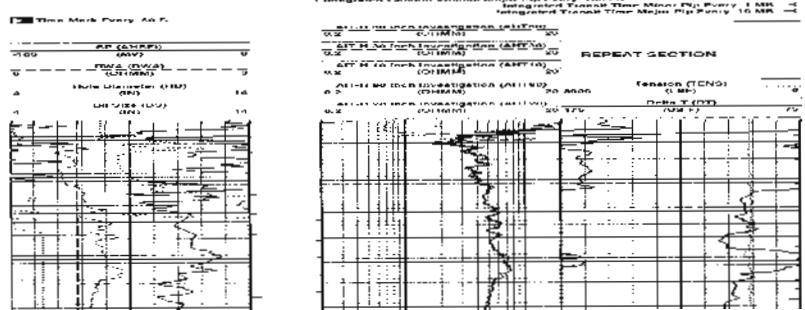
OP System Version: 12C0-301

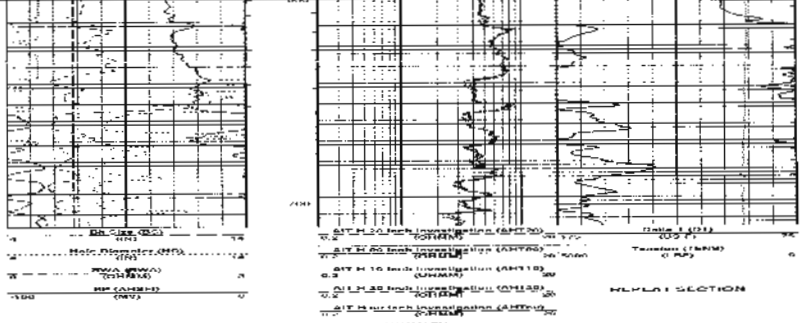
AIT-H	12C0-301	MCG-B	12C0-301
DSLT-TCC	12C0-301	TCC-AP	12C0-301

PIP SUMMARY

- Integrated Hole Volume Minor Pip Every 10 FT
- Integrated Hole Volume Major Pip Every 100 FT
- Integrated Cement Volume Minor Pip Every 10 FT
- Integrated Cement Volume Major Pip Every 100 FT
- Integrated Transit Time Minor Pip Every 1 MS
- Integrated Transit Time Major Pip Every 10 MS

Time Mark Every 60 S





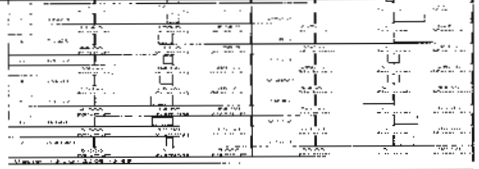
RLPLAT SECTION

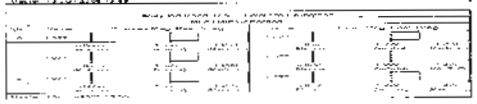
OP SUMMARY

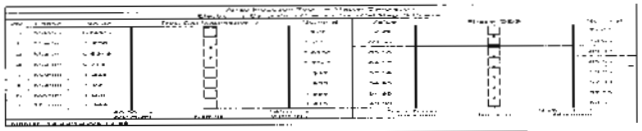
Time Mark Every 60 S

Parameters

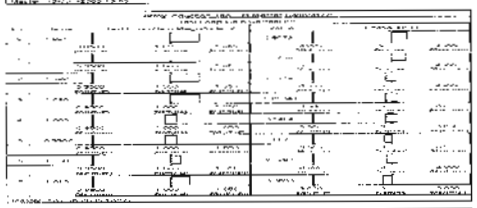
DLIS Name	Description	Value
AIRREV	AIT-H Array Induction Tool	8
AIRSEQ	Array Induction Borehole Correction Mode	1 - Computed/electronic/downhole
AIRSPU	Array Induction Borehole Correction Profile Variation Number	4268
AIRSUM	Array Induction Basic Logs Mode	A Pair, Two and Four
AIRVER	Array Induction BASIC LOGS Code Version Number	8
AIRVERD	Array Induction Desktop Code Version Number	1
AIRVERE	Array Induction Desktop Code Version Number (Eurasuite)	Continental
AIRVERM	Array Induction Real Time Code Version Number	08-Feb-05 Rev 3
AIRVERV	Array Induction Real Time Code Version Number	08-Feb-05 Rev 3
AIRVERV	Array Induction Response Set Versions for Tool Resolution	08-Feb-05 Rev 3
AIRVERV	Array Induction Response Set Versions for Tool Resolution	08-Feb-05 Rev 3
AITH_SHORE	AITH_SHORE	0.508
AITH_SHORE	AITH_SHORE	0.508
AITH_SHORE	AITH_SHORE	0.508

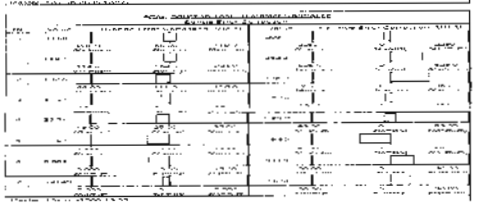




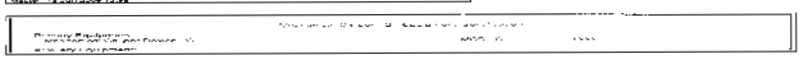




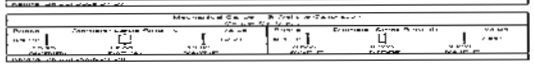












Company:	Source Energy Corp.
Well:	King Island 1-28
Field:	King Island Gas
County:	San Joaquin
State:	California

Schlumberger

ARRAY INDUCTION / SP
BHC SONIC / CALIPER
SCALE 5" = 100'

2MUD1



GEOLOGICAL WELL LOGGING

trata-graphic Corp.

P.O. Box 41468 Sacramento, CA 95621

ABBREVIATIONS		MUD DATA	
NEW BIT	NB	MUD WEIGHT	MW
RE - RUN BIT	RRB	MUD VISCOSITY	MV
RE - TIP BIT	RTB	WATER LOSS	WL
CORE BIT	CB	SAND %	SD
CHECK FLOW	CF	SALINITY	SAL
CIRCULATE OUT	CO	RESISTIVITY	RM
TRIP GAS	TG	FILTRATE RESIS.	RMF
CONNECTION GAS	CG	PLASTIC VISC.	PV
WIPE HOLE GAS	WHG	YIELD POINT	YP
SURVEY GAS	SG	SOLIDS	SOL
NO RETURNS	NR	PH	PH
LOG AFTER TRIP	LAT		
DRILL STEM TEST	DST		

SYMBOLS

- DRILL STEM TEST
- CASING SHOE
- CORED INTERVAL NO RECOVERY
- SIDEWALL CORE

LITHOLOGY

CLAY, SHALE, SILTSTONE, SANDY SILTSTONE, FINE SAND, MEDIUM SAND, COARSE SAND, SANDSTONE, CONGLOMERATE, LIGNITE, LIMESTONE, DOLOMITE, VOLCANIC, IGNEOUS, METAMORPHIC, CHERT, CEMENT

HOLE SIZE

12-1/4"	to	568'
7-7/8"	to	5600'
	to	

CASING SIZE

8-5/8"	to	566'
	to	
	to	

MUD TYPE

SPUD MUD	to	568'
CYPAN	to	5500'
	to	

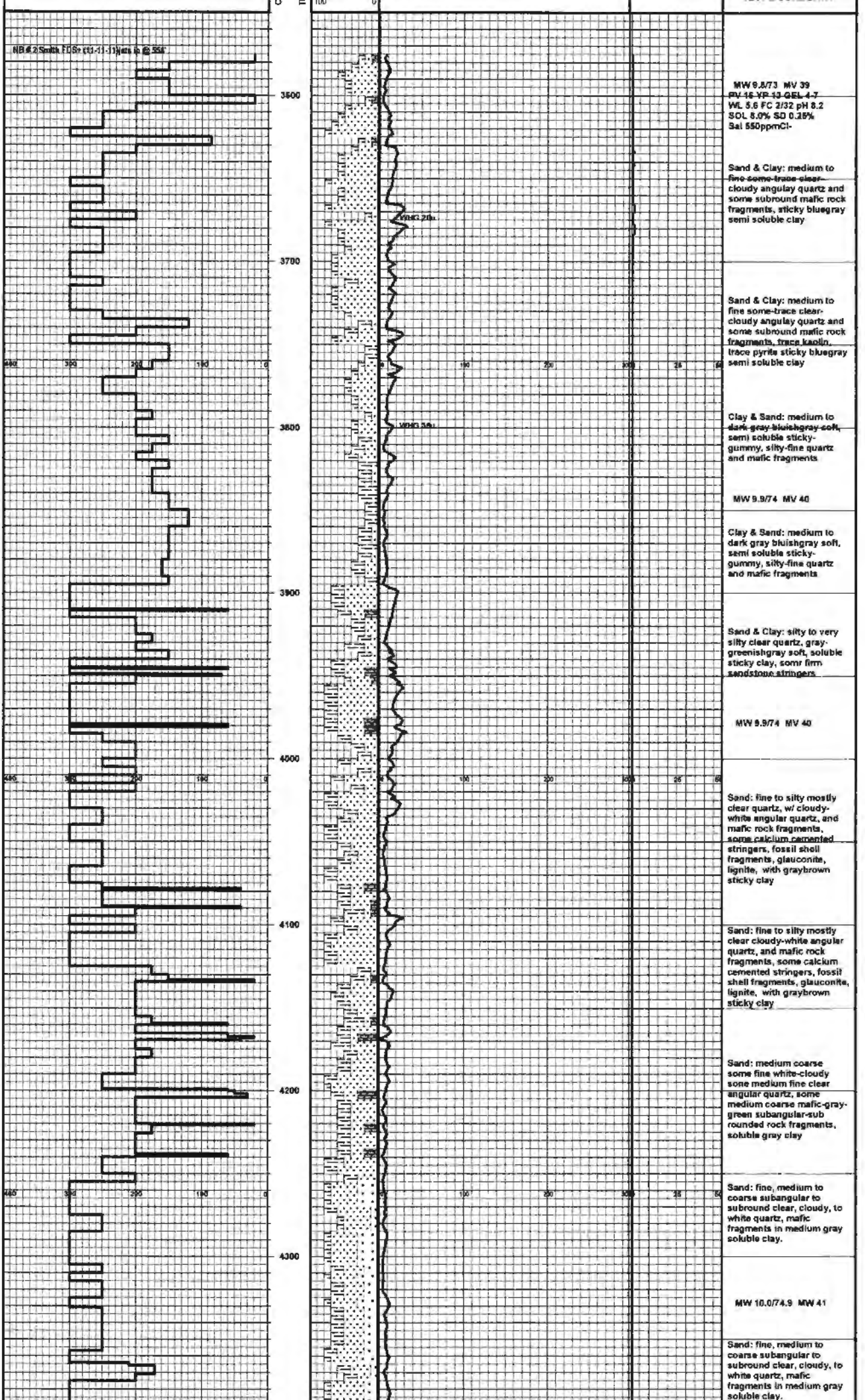
MUD PUMPS

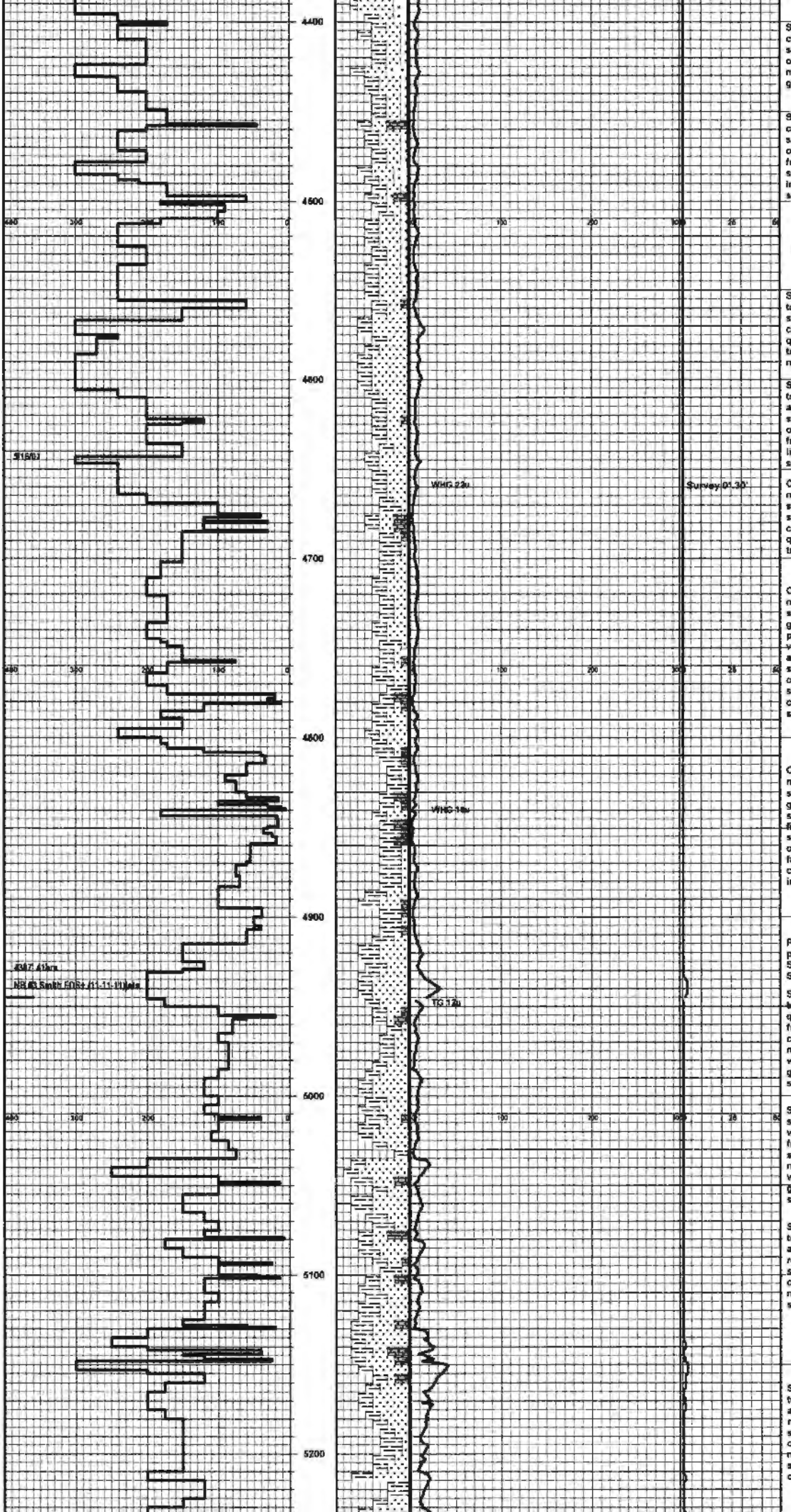
TYPE 1 - NATIONAL 8 P 80
1 6" x 8.5"
TYPE 2 - NATIONAL 7 P 80
2 6.5" x 7.75"

COMPANY: PRINCETON NATURAL GAS
WELL: KING ISLAND #33-1
API NO.: 04-077-29586
FIELD: KING ISLAND GAS
LOCATION Fr NE Cor 33 1S 10E 4W
Sec. 33, T3N-R5E, MDB&M.
X=1733221, Y=573961
ELEVATION: GL -6' KB +7'
COUNTY SAN JOAQUIN
STATE CALIFORNIA
SPUD DATE: 5/13/07 TIME 6:00AM
LOGGING DATE: FROM 5/15/07 TO 5/17/07
LOGGING DEPTH: FROM 3575' TO 5500'
WELL SITE GEOL.
OP. GEOL. & ENG. TOM FASSIO
DRLG. FORMAN MATT VAUGHN / IRANI ENG.
DRLG. CONTR. ENSIGN US DRILLING
RIG 506
TOOL PUSHER DAVE FISHER / LARRY OLIVER
MUD CONTR. GEO DRILLING FLUIDS
MUD ENG. MIKE CANDITO
LOGGING GEOL. 1. R. L. SWARENS
2. EVAN HOPSON
3.

GAS DETECTOR CALIBRATION 100 UNITS 2% METHANE BY VOLUME SCALE 2" = 100'

DRILLING RATE FT./HR.	DEPTH	LITH.	TOTAL GAS	CUTTINGS	REMARKS
DRILL RATE	CORE TEST	IN PERCENT	AGITATED GAS PETROLEUM VAPORS	CUTTING GAS	LITH DESCRIPTION MUD DATA DRILLING DATA TEST & CORE DATA


3500
3700
3800
3900
4000
4100
4200
4300
MW 9.8/73 MV 39
PV 16 YP 13 GEL 4-7
WL 5.6 FC 2/32 pH 8.2
SOL 8.0% SD 0.25%
Sal 550ppmCl-
Sand & Clay: medium to fine some-trace clear-cloudy angular quartz and some subround mafic rock fragments, sticky bluegray semi soluble clay
Sand & Clay: medium to fine some-trace clear-cloudy angular quartz and some subround mafic rock fragments, trace kaolin, trace pyrite sticky bluegray semi soluble clay
Clay & Sand: medium to dark gray bluishgray soft, semi soluble sticky-gummy, silty-fine quartz and mafic fragments
MW 9.9/74 MV 40
Clay & Sand: medium to dark gray bluishgray soft, semi soluble sticky-gummy, silty-fine quartz and mafic fragments
Sand & Clay: silty to very silty clear quartz, gray-greenishgray soft, soluble sticky clay, somr firm sandstone stringers
MW 9.9/74 MV 40
Sand: fine to silty mostly clear quartz, w/ cloudy-white angular quartz, and mafic rock fragments, some calcium cemented stringers, fossil shell fragments, glauconite, lignite, with graybrown sticky clay
Sand: fine to silty mostly clear cloudy-white angular quartz, and mafic rock fragments, some calcium cemented stringers, fossil shell fragments, glauconite, lignite, with graybrown sticky clay
Sand: medium coarse some fine white-cloudy sone medium fine clear angular quartz, some medium coarse mafic-gray-green subangular-sub rounded rock fragments, soluble gray clay
Sand: fine, medium to coarse subangular to subround clear, cloudy, to white quartz, mafic fragments in medium gray soluble clay.
MW 10.0/74.9 MW 41
Sand: fine, medium to coarse subangular to subround clear, cloudy, to white quartz, mafic fragments in medium gray soluble clay.



Sand: fine, medium to coarse subangular to subround clear, cloudy, opaque, white quartz, mafic fragments in medium gray soluble clay.

Sand: fine, medium to coarse subangular to subround clear, cloudy, opaque, white quartz, mafic fragments, occassional silty calcareous cemented interbeds in medium gray soluble clay.

MW 10.0/75.0 MV 40

Sand & Clay: silty very fine to mediumcoarse angular, subangular, to subround clear, cloudy, opaque quartz, mafic fragments, trace pyrite in light to medium gray matrix.

Sand & Clay: silty very fine to medium, trace coarse angular, subangular, to subround clear, cloudy, opaque quartz, mafic fragments, trace pyrite, light to medium gray soluble clay

Clay & Sand: light to medium gray soft, soluble, sticky matrix with angular, subangular, to subround clear, cloudy, opaque quartz, mafic fragments, trace pyrite.

Clay & Siltstone: light to medium gray soft, soluble, sticky matrix, kaolin, dark gray moderately firm, platysiltstone with silty, very fine to minimal fine angular, subangular, to subround clear, cloudy, opaque quartz, mafics, some silty calcareous cemented interbeds and sandstone fragments.

Clay & Siltstone: light to medium gray soft, soluble, sticky matrix, kaolin, dark gray moderately firm, platy siltstone with trace very fine angular, subangular, to subround clear, cloudy, opaque quartz, mafic fragments, some silty calcareous cemented interbeds.

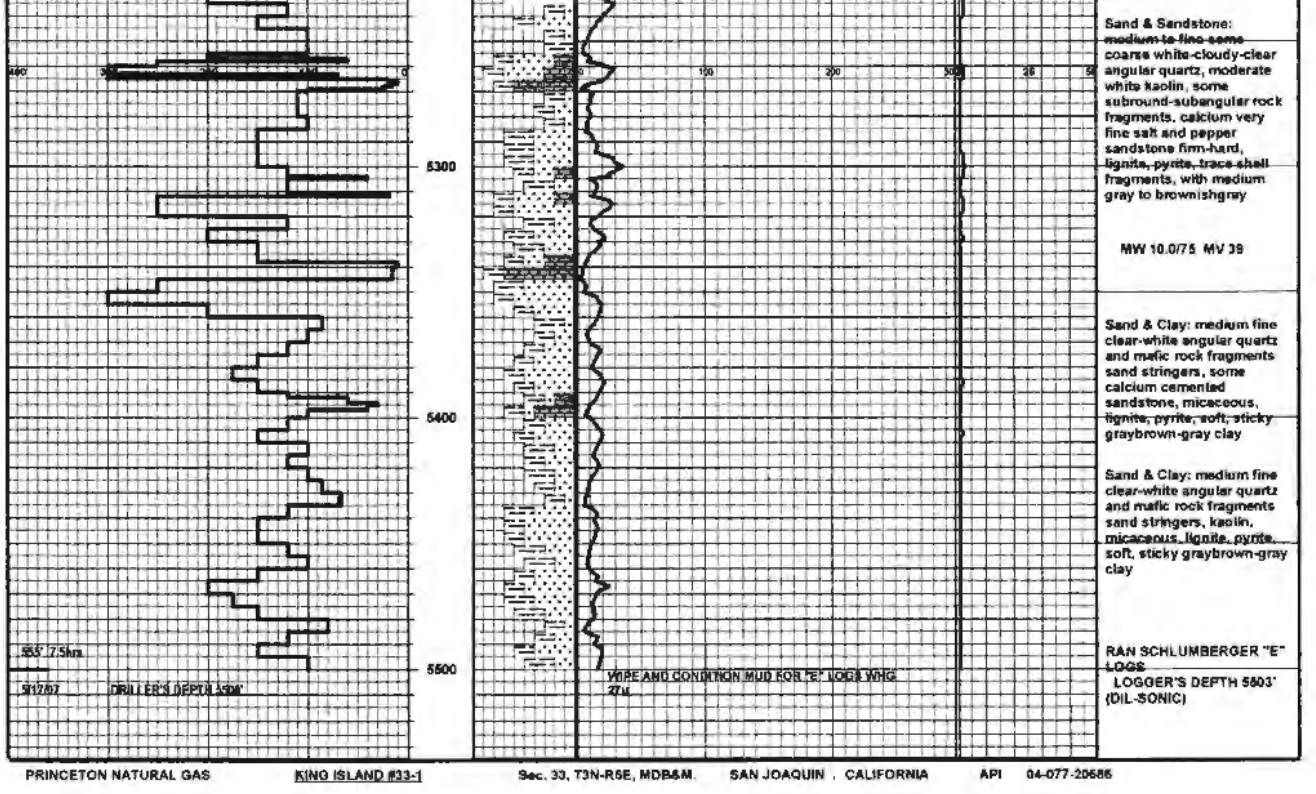
MW 10.0/74.9 MV 40
PV 18 YP 12 GEL 3/4
pH 8.0 WL 5.2 FC 2/32
SOL 9.0% SD 0.25%
SAL 620 ppm Cl-

Sand: medium to silty clear to cloudy white angular quartz, some mafic rock fragments, kaolin, some cemented, micro micaceous, lignite, pyrite, with medium gray to graybrown semi soluble sticky-gummy clay

Sand: medium to silty some coarse clear-cloudy-white angular quartz, rock fragments some cemented sandstone, micro micaceous, lignite, pyrite, with medium some dark gray-brown/gray sticky semi soluble clay

Sand & Clay: medium fine to some coarse clear-white angular quartz and mafic rock fragments sand stringers, some calcium cemented sandstone, micaceous, lignite, pyrite, sticky graybrown-gray clay
MW 10.0/75 MV 40

Sand & Clay: medium fine to some coarse clear-white angular quartz and mafic rock fragments sand stringers, some calcium cemented sandstone, micaceous, lignite, pyrite, soft, sticky graybrown-gray clay



PRINCETON NATURAL GAS KING ISLAND #33-1 Sec. 33, T3N-R5E, MDB&M. SAN JOAQUIN , CALIFORNIA API 04-077-20686

2SON1

Schlumberger

Company: PRINCETON NATURAL GAS

Well: KING ISLAND 33-1

Field: KING ISLAND GAS

County: SAN JOAQUIN State: CALIFORNIA

ARRAY INDUCTION / SP

BHC SONIC / FOUR ARM CALIPER

SCALE: 2"=100'

County: SAN JOAQUIN
Field: KING ISLAND GAS
Location: X: 1733221
Well: KING ISLAND 33-1
Company: PRINCETON NATURAL GAS

LOCATION

X: 1733221
Y: 573861
MDB&M

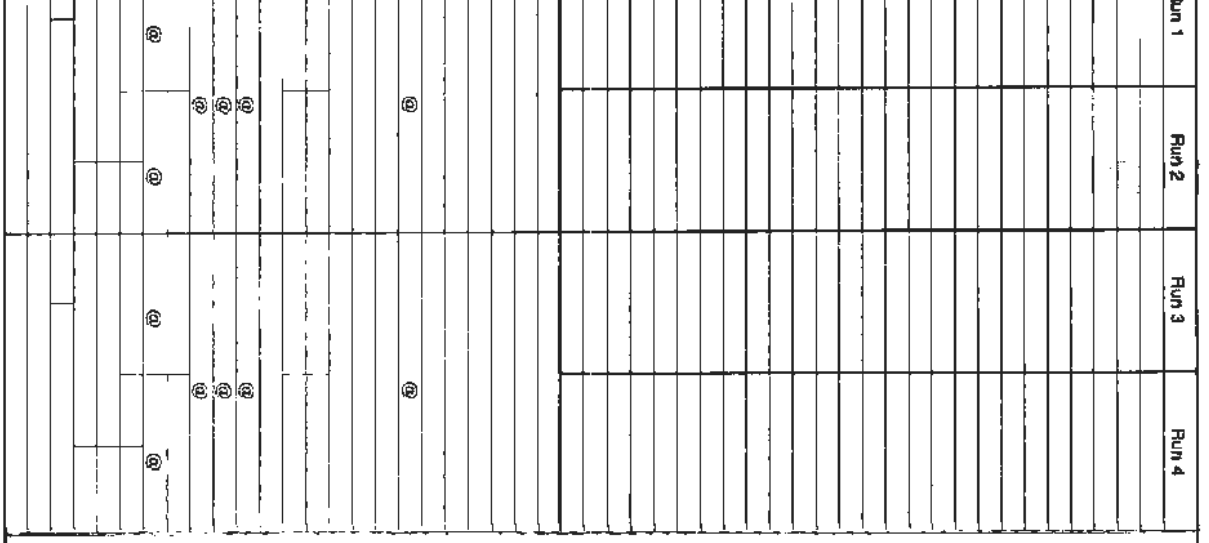
Elev.: K.B. 7 ft
G.L. -6 ft
D.F.

Permanent Datum: GROUND LEVEL Elev.: -6 ft
Log Measured From: K.B. 13.0 ft above Perm Datum
Drilling Measured From: K.B.

API Serial No.	Section	Township	Range
04-077-20686	33	3N	5E

Logging Date			17-May-2007				Logging Date
Run Number			1				Run Number
Depth Driller			5500 ft				Depth Driller
Schlumberger Depth			5503 ft				Schlumberger Depth
Bottom Log Interval			5497 ft				Bottom Log Interval
Top Log Interval			556 ft				Top Log Interval
Casing Driller Size @ Depth			8.625 in @ 556 ft				Casing Driller Size @ Depth
Casing Schlumberger			556 ft				Casing Schlumberger
Bit Size			7.875 in				Bit Size
Type Fluid In Hole			CYPAN				Type Fluid In Hole
MUD	Density	Viscosity	10 lbm/gal	40 s			MUD Density / Viscosity
	Fluid Loss	PH	5 cm3	7.5			Fluid Loss / PH
	Source Of Sample		FLOWLINE				Source Of Sample
RM @ Measured Temperature			1.536 ohm.m @ 81 degF		@		RM @ Measured Temperature
RMF @ Measured Temperature			1.368 ohm.m @ 82 degF		@		RMF @ Measured Temperature
RMC @ Measured Temperature			3.552 ohm.m @ 82 degF		@		RMC @ Measured Temperature
Source RMF	RMC		PRESS	PRESS			Source RMF / RMC
RM @ MRT	RMF @ MRT		0.998 @ 128	0.901 @ 128	@	@	RM @ MRT / RMF @ MRT
Maximum Recorded Temperatures			128 degF	128	128		Maximum Recorded Temperatures
Circulation Stopped	Time		17-May-2007	7:00			Circulation Stopped / Time
Logger On Bottom	Time		17-May-2007	10:41			Logger On Bottom / Time
Unit Number	Location		3152 SACRAMENTO				Unit Number / Location
Recorded By			M. KHAN				Recorded By
Witnessed By			Partick Ross/ Tom Fassio				Witnessed By

2007 MAY 30 PM 5:04



DISCLAIMER

THE USE OF AND RELIANCE UPON THIS RECORDED-DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS AFFILIATES, PARTNERS, REPRESENTATIVES, AGENTS, CONSULTANTS AND EMPLOYEES) IS SUBJECT TO THE TERMS AND CONDITIONS AGREED UPON BETWEEN SCHLUMBERGER AND THE COMPANY, INCLUDING: (a) RESTRICTIONS ON USE OF THE RECORDED-DATA; (b) DISCLAIMERS AND WAIVERS OF WARRANTIES AND REPRESENTATIONS REGARDING COMPANY'S USE OF AND RELIANCE UPON THE RECORDED-DATA; AND (c) CUSTOMER'S FULL AND SOLE RESPONSIBILITY FOR ANY INFERENCE DRAWN OR DECISION MADE IN CONNECTION WITH THE USE OF THIS RECORDED-DATA

OTHER SERVICES1	OTHER SERVICES2
OS1: none	OS1:
OS2:	OS2:
OS3:	OS3:
OS4:	OS4:
OS5:	OS5:
REMARKS: RUN NUMBER 1	REMARKS: RUN NUMBER 2
TOOL RUN CENTRALIZED.	
RIG: ENSIGN 506	
THANK YOU FOR CHOOSING SCHLUMBERGER	

RUN 1			RUN 2		
SERVICE ORDER #:		10894888	SERVICE ORDER #:		
PROGRAM VERSION:		15C0-309	PROGRAM VERSION:		
FLUID LEVEL:		0 ft	FLUID LEVEL:		
LOGGED INTERVAL	START	STOP	LOGGED INTERVAL	START	STOP

EQUIPMENT DESCRIPTION

RUN 1 RUN 2

SURFACE EQUIPMENT

GSR-U/Y
NCT-B
CNB-AB
NCS-VB
WITM (DTS)-A

DOWNHOLE EQUIPMENT

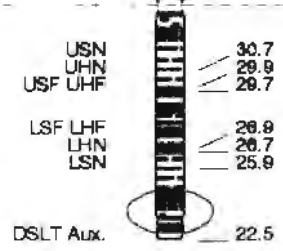


LEH-QT LEH-QT			56.5
DTC-H ECH-KC 10057 DTCH0-A 8975 DTCH1-A	CTEM TelStatus ToolStatu HGNS HTEM	54.8 52.8	55.6
HILTB-FTB HGNSD-B 828 HMCA HGNH 2760 NLS-KL NSR-F 2289 HACCZ HCNT HGR NPV-N	HMCA HGNS Gamm HGNS Neut HGNS Neut HGNS sens	52.6 51.8 48.0 45.5 43.2	52.6

DSLT-FTB
DSLC-B 8011
ECH-KH 8058
SLS-W 330

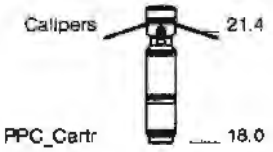
43.2





PPC1-A
PPC1-A 8159
PPC_CAL_STD 8159

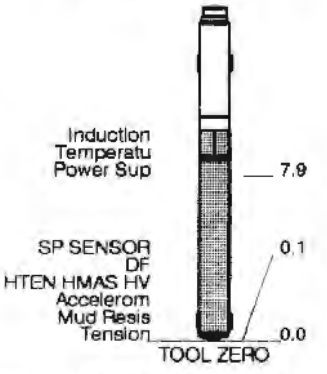
22.5



HAIT-H
AHIS-BA 299
AHRM-A 299

16.0

0.5 IN
Standoff



0.5 IN
Standoff

MAXIMUM STRING DIAMETER 4.88 IN
MEASUREMENTS RELATIVE TO TOOL ZERO
ALL LENGTHS IN FEET

Schlumberger

MAIN LOG
2"=100'

MAXIS Field Log

Input DLIS Files

DEFAULT	AIT_CAL_SONIC_TLD_008LUP	FN:7	PRODUCER	17-May-2007 10:59	5502.0 FT	524.0 FT

Output DLIS Files

DEFAULT	AIT_CAL_SONIC_TLD_018PUP	FN:17	PRODUCER	17-May-2007 12:39	5507.0 FT	533.0 FT

Integrated Hole/Cement Volume Summary

Hole Volume = 1782.42 F3

Cement Volume = 1236.55 F3 (assuming 4.50 IN casing O.D.)

Computed from 5500.0 FT to 558.0 FT using data channel(s) CRD1_PPC1 CRD2_PPC1 CRD3_PPC1 CRD4_PPC1

OP System Version: 15C0-309

MCM

HAIT-H	15C0-309	PPC1-A	15C0-309
DSLT-FTB	15C0-309	HILTB-FTB	15C0-309
DTC-H	15C0-309		

PIP SUMMARY

- Integrated Hole Volume Minor Pip Every 10 F3
- Integrated Hole Volume Major Pip Every 100 F3
- Integrated Cement Volume Minor Pip Every 10 F3
- Integrated Cement Volume Major Pip Every 100 F3

Integrated Transit Time Minor Pip Every 1 MS
Integrated Transit Time Major Pip Every 10 MS
Time Mark Every 60 S

SP (SP)		
-100	(MV)	0

RWA (RWA)		
0	(OHMM)	3

PPC1 Hole Diameter 1 (HD1_PPC1)		
6	(IN)	16

Bit Size (BS)		
6	(IN)	16

AIT-H 20 Inch Investigation (AHF20)		
0	(OHMM)	20

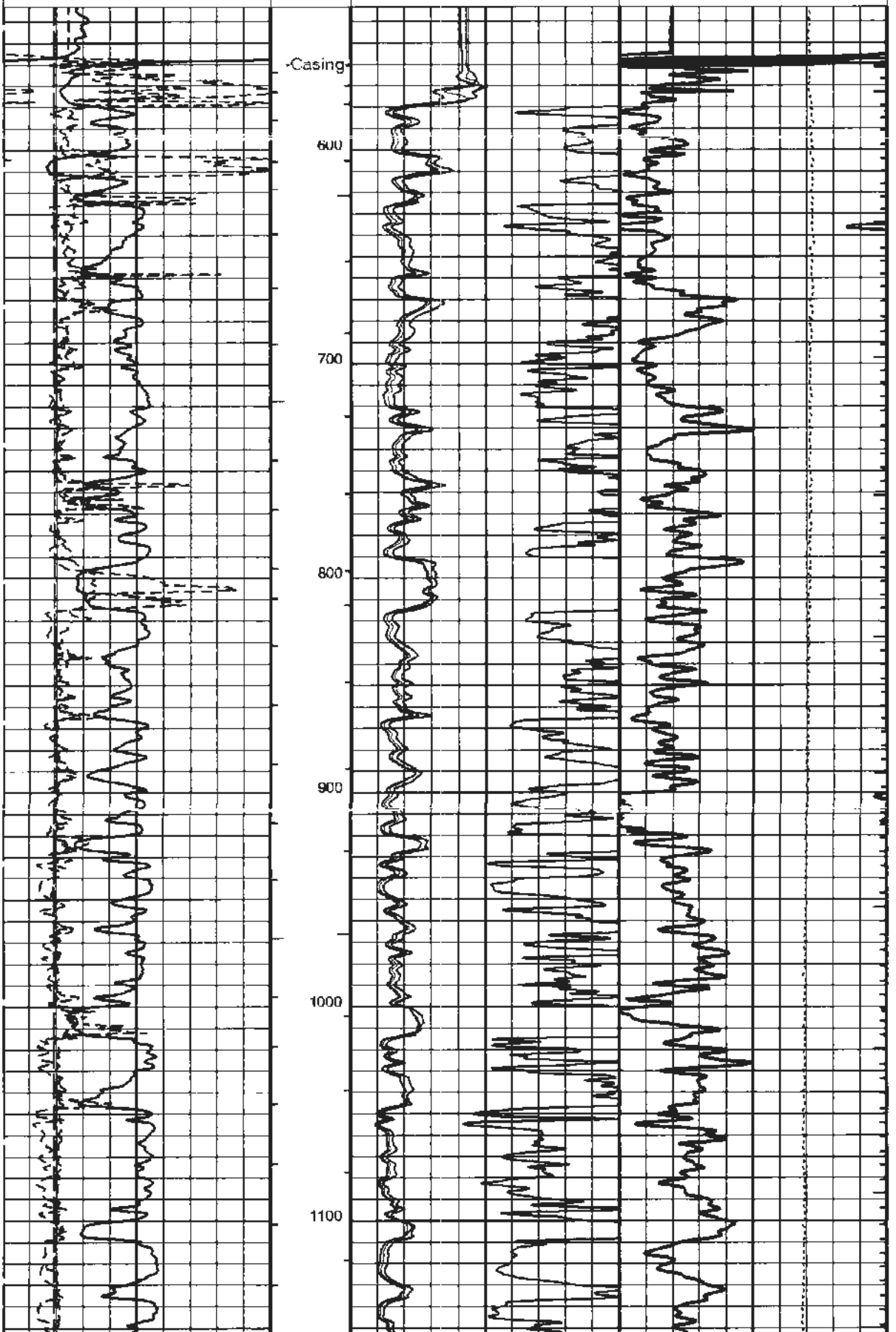
AIT-H 20 Inch Investigation (AHT20)		
0	(OHMM)	4

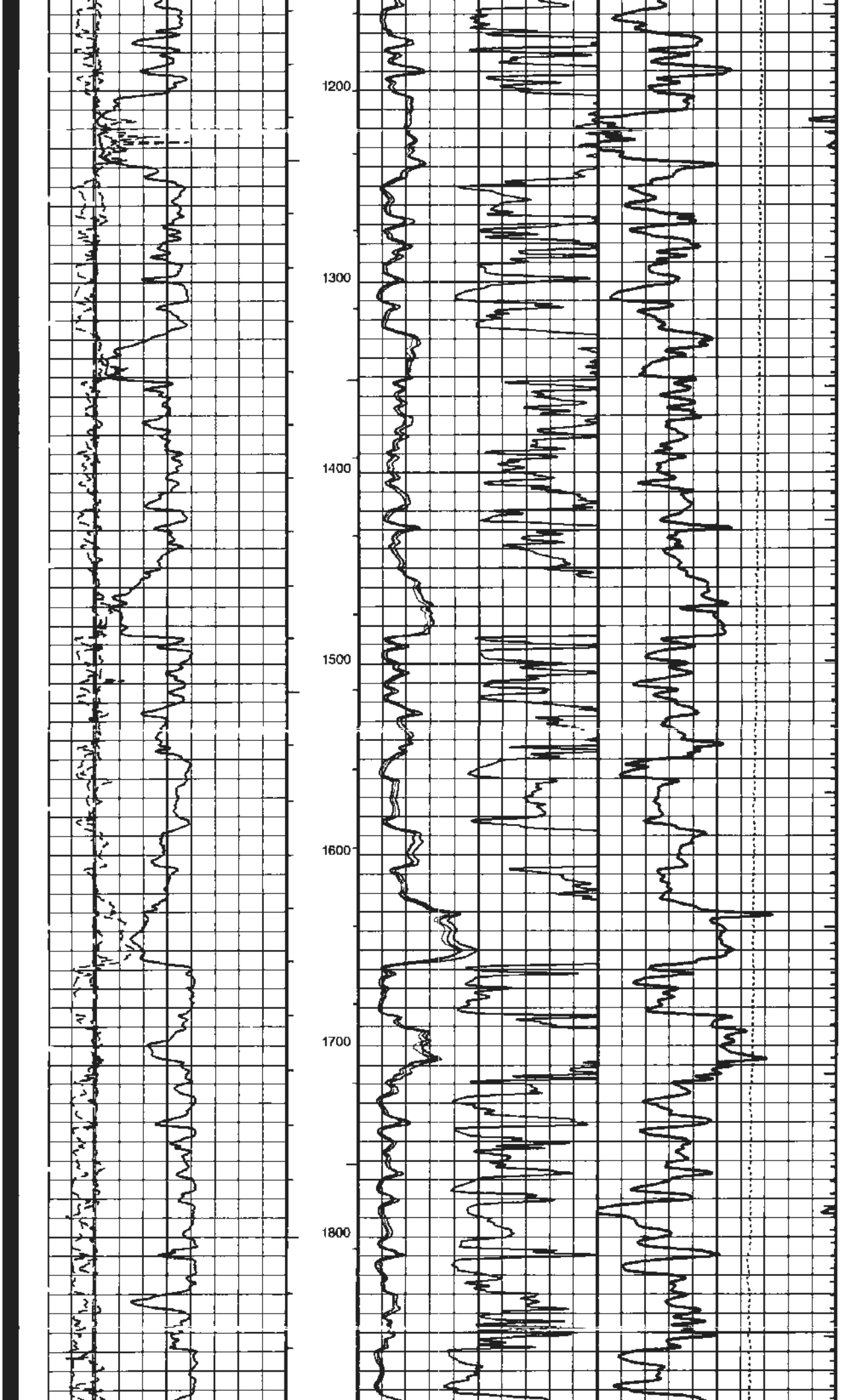
AIT-H 10 Inch Investigation (AHF10)		
0	(OHMM)	20

AIT-H 90 Inch Investigation (AHF90)		
0	(OHMM)	20

Tension (TENS)		
5000	(LBF)	0

Delta-T (DT)		
175	(US/F)	75

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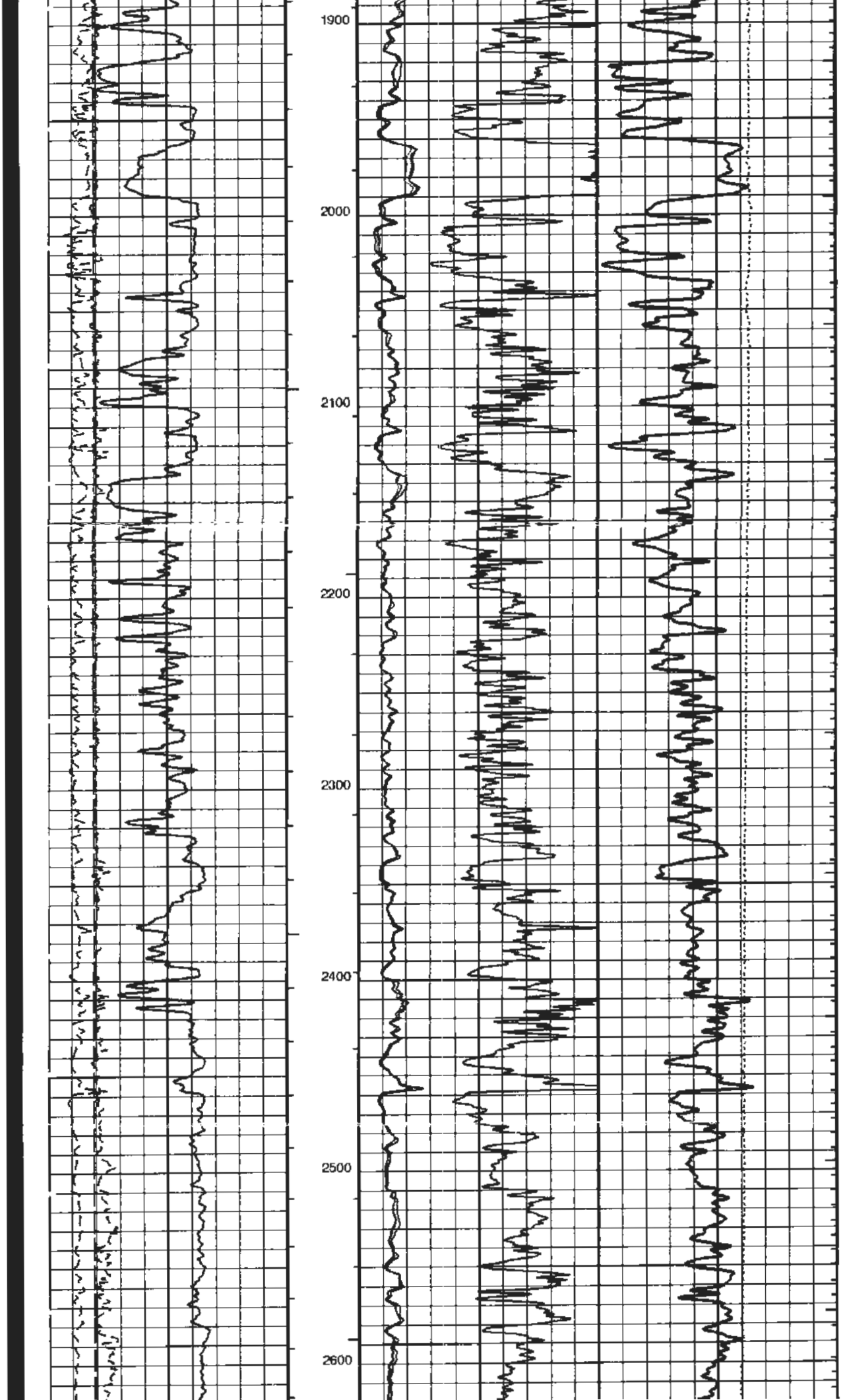
1300
1400
1500
1600
1700
1800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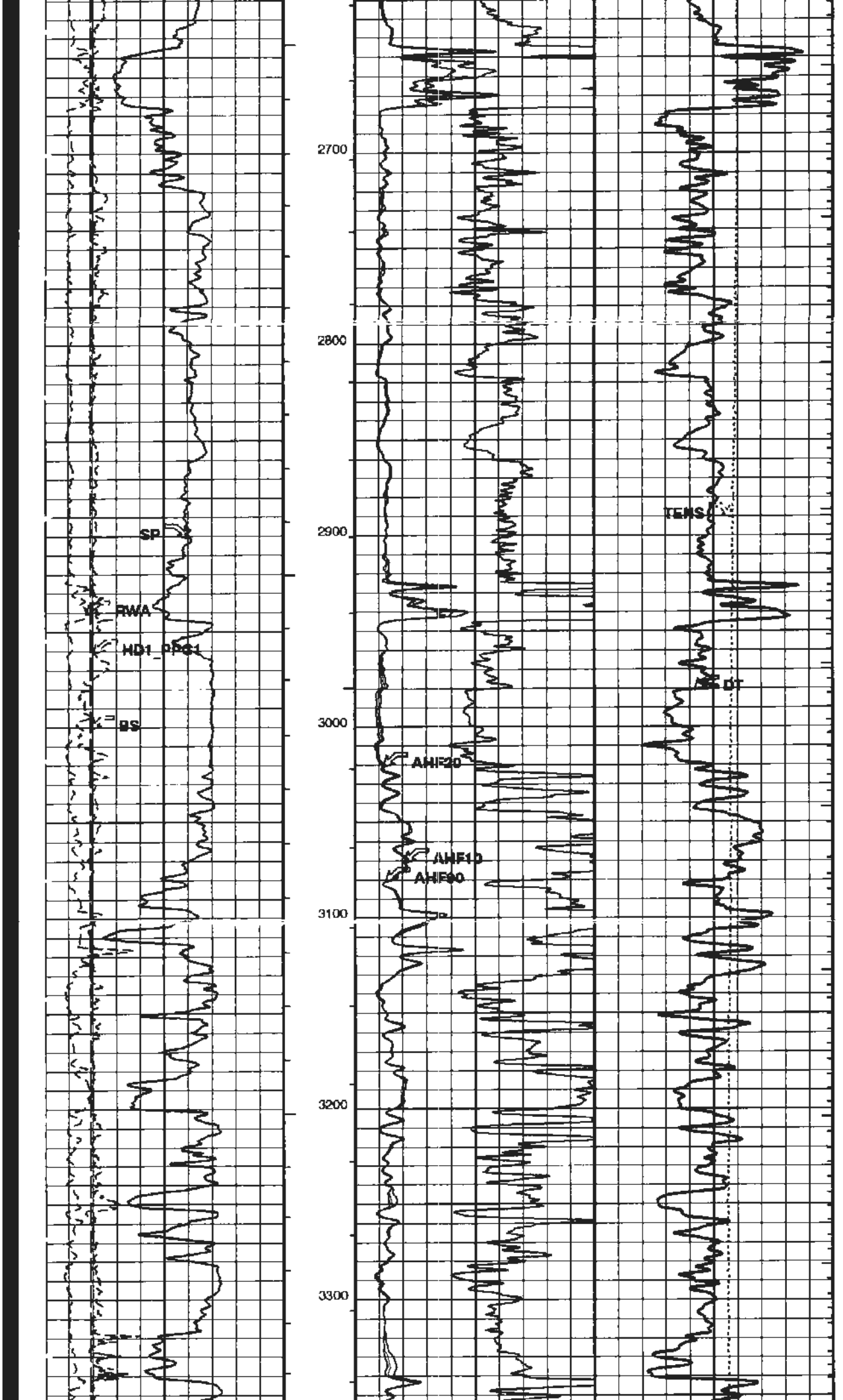
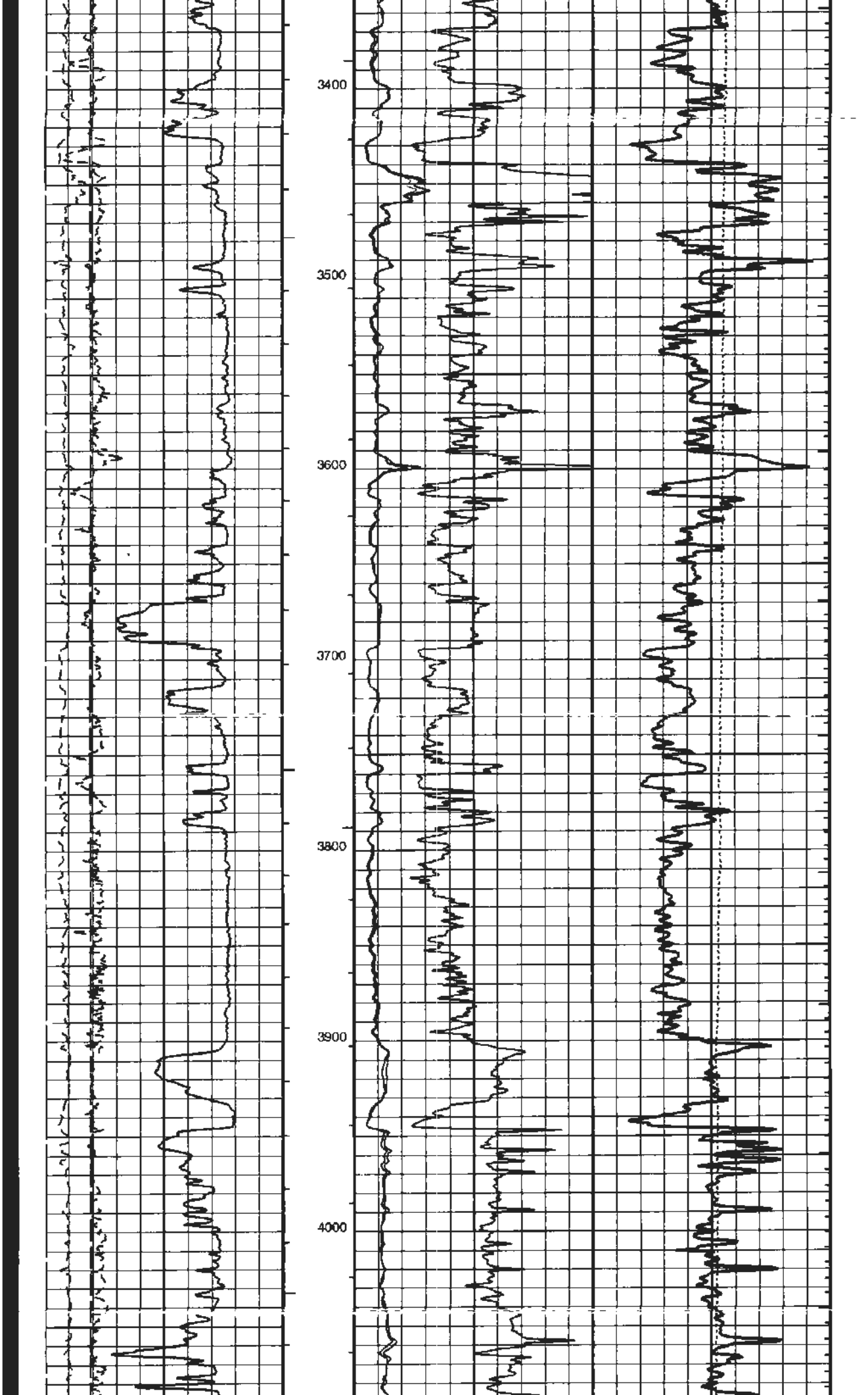
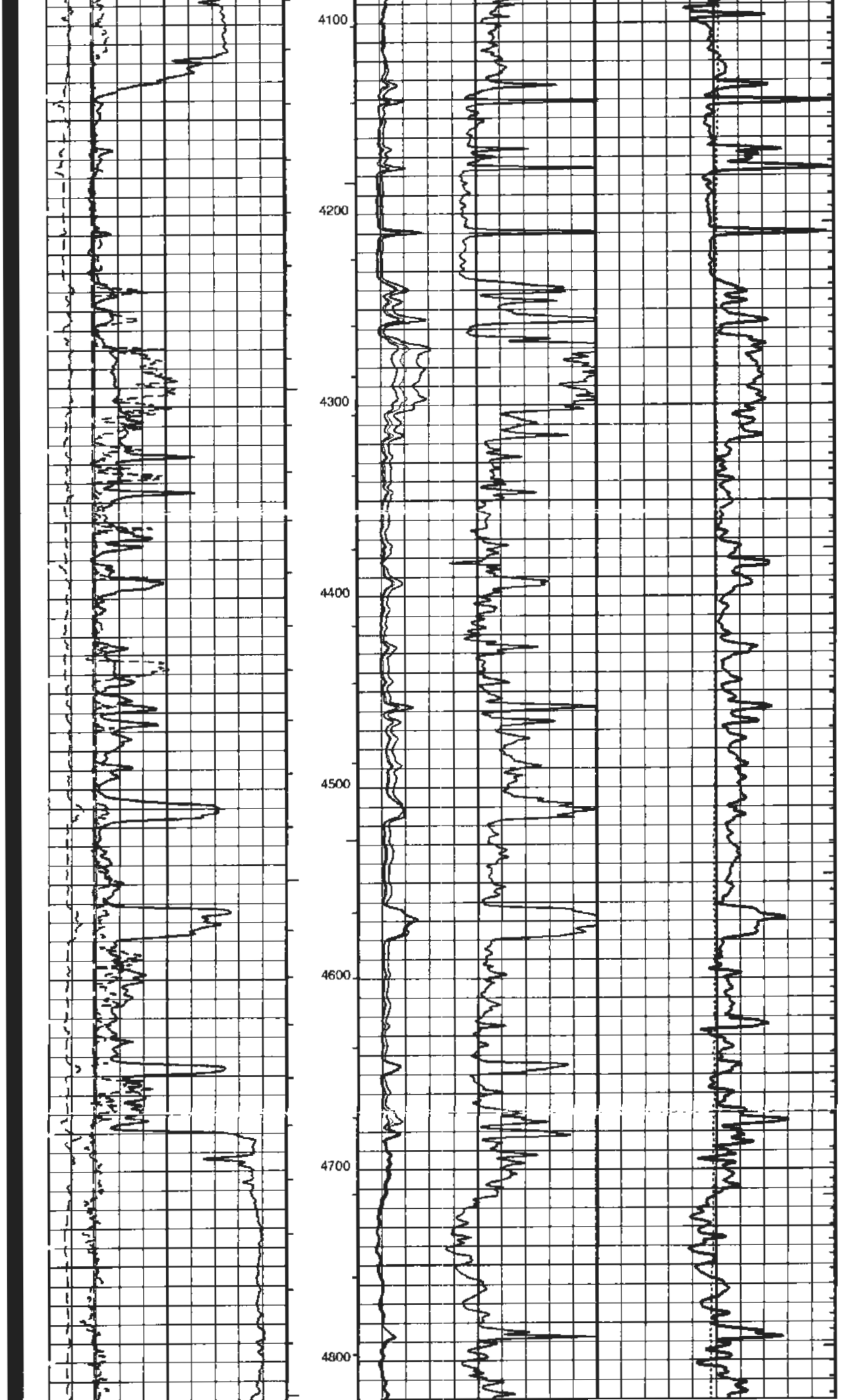
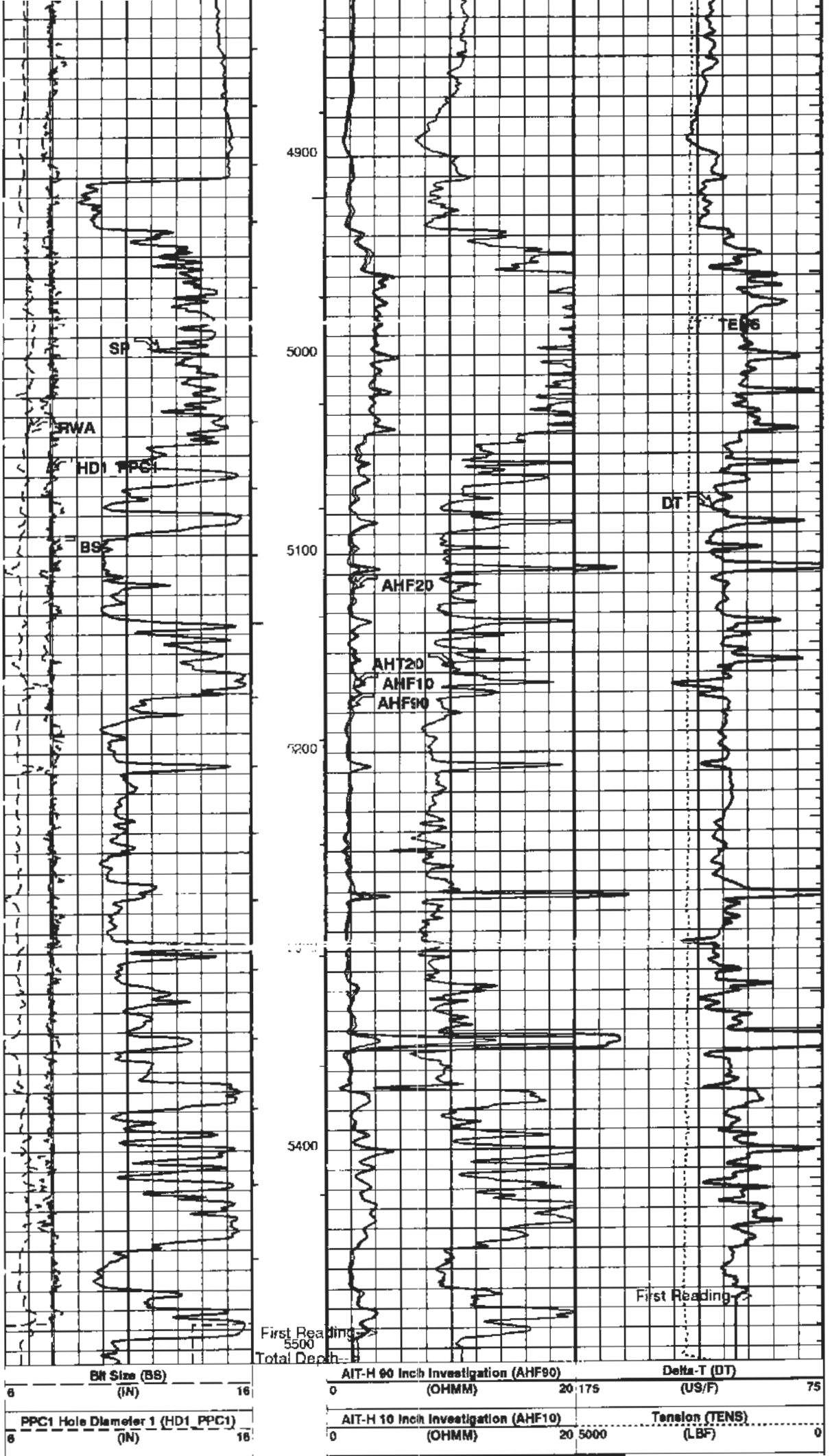
2000
2100
2200
2300
2400
2500
2600


SP
RWA
HD1_DPG1
BS
2700
2800
2900
TEMS
DT
3000
AHF20
AHF10
AHF90
3100
3200
3300


3400
3500
3600
3700
3800
3900
4000


4100
4200
4300
4400
4500
4600
4700
4800


SP
RWA
HD1 PPC1
BS
AHF20
AHT20
AHF10
AHF90
TENS
DT
4900
5000
5100
5200
5400
First Reading
5500
Total Depth
First Reading
Bit Size (BS)
6 (IN) 16
PPC1 Hole Diameter 1 (HD1_PPC1)
6 (IN) 16
AIT-H 90 Inch Investigation (AHF90)
0 (OHMM) 20
AIT-H 10 Inch Investigation (AHF10)
0 (OHMM) 20
Delta-T (DT)
175 (US/F) 75
Tension (TENS)
5000 (LBF) 0

RWA (RWA)		
0	(OHMM)	3

SP (SP)		
-100	(MV)	0

AIT-H 20 Inch Investigation (AHT20)		
0	(OHMM)	4

AIT-H 20 Inch Investigation (AHF20)		
0	(OHMM)	20

PIP SUMMARY

- Integrated Hole Volume Minor Pip Every 10 F3
- Integrated Hole Volume Major Pip Every 100 F3
- Integrated Cement Volume Minor Pip Every 10 F3
- Integrated Cement Volume Major Pip Every 100 F3
- Integrated Transit Time Minor Pip Every 1 MS
- Integrated Transit Time Major Pip Every 10 MS

Time Mark Every 60 S

Format: 2INCH Vertical Scale: 2" per 100' Graphics File Created: 17-May-2007 12:39

OP System Version: 15C0-309

MCM

HAIT-H	15C0-309	PPC1-A	15C0-309
DSLT-FTB	15C0-309	HILTB-FTB	15C0-309
DTC-H	15C0-309		

Input DLIS Files

DEFAULT	AIT_CAL_SONIC_TLD_008LUP	FN:7	PRODUCER	17-May-2007 10:59	5502.0 FT	524.0 FT

Output DLIS Files

DEFAULT	AIT_CAL_SONIC_TLD_018PUP	FN:17	PRODUCER	17-May-2007 12:39

Company: PRINCETON NATURAL GAS

Well: KING ISLAND 33-1
Field: KING ISLAND GAS
County: SAN JOAQUIN
State: CALIFORNIA

Schlumberger

ARRAY INDUCTION / SP
BHC SONIC / FOUR ARM CALIPER
SCALE: 2"=100'

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF WELL PLUGGING AND ABANDONMENT

Sacramento, California
January 4, 2008

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Your report of the plugging and abandonment of well "King Island" 33-1, A.P.I. No. 077-20686, Section 33, T 3N, R 5E, MD B. & M., field, San Joaquin County, dated 6/08/2007, received 6/11/2007, has been examined in conjunction with records filed in this office. We have determined that all of the requirements of this Division have been fulfilled relative to plugging and abandonment of the well, removal of well equipment and junk, and filing of well records.

NOTES: 1. Surface plugging completed on 5/18/2007.

2. Site inspection made and approved 12/20/2007.

BOND: Blanket

STATUS: Confidential

Released from conf. 3-19-2009

Hal Bopp
State Oil and Gas Supervisor

By Robert S. Habel
Robert S. Habel
Deputy Supervisor

RSH/lmd

OG159 (9/01)

DISTRICT 6 - WELL RECORDS CHECKLIST

API# 077-20686

WELL ID: King Island 33-1

NOTICE FOR: X drill X abd ____ rw ____ rd

P numbers 607-287 & 607-366

RECORDS RECEIVED	Date Rec'd	Records ok	Copies in box for IHS	NORD	121 Entry	Remarks
Well Summary (OG100)	6/11/07	✓	✓		SD	
History (OG103)	6/11/07	✓	✓		SD	
Directional Survey	NA				/	
E-logs (2")	5/30/07	✓	✓		SD	
E-logs (5")						
MUD Logs	5/24/07	✓	✓		SD	
CBL						
Other						

X **CONFIDENTIAL**
RELEASE DATE 5/18/09

SURFACE INSPECTION
Date 12/20/07
Engineer RL

ABANDONMENT

✓ NEEDS Surface Inspection
To S.I. bin - 7/30/07 SD

MAP MADE for Surface Inspection PMC

STATUS		Mapped/DB
Producing-gas	____	____
Idle-gas	____	____
Abandoned-gas	____	____
Drilling-Idle	✓	____
Abandoned-dry hole	✓	____
Water Disposal	____	____
Other ____	____	____
No change ____		

Date Completed 5/18/07

Surface Inspection COMPLETED by RL
DATE 12/20/2007

X FINAL LETTER NEEDED
Final Letter completed by: SD Date: 1/4/08

Remarks (07-conf)

BOND RELEASE ____
DATE ____

Database entry by: PMC
MAP # 610

RECORDS APPROVED
BY: PMC DATE: 1/2/08

121 entry ✓ SD 1/8/08

DEPARTMENT OF CONSERVATION

'SION OF OIL, GAS, AND GEOTHERMAL RESOUI 'S

WELL SUMMARY REPORT

API NO. 077-20686

Operator	Well				
Princeton Natural Gas, LLC	**"King Island" 33-1**				
Field	County	Sec.	T.	R.	B.&M.
	San Joaquin	**33**	**3N**	**5E**	**M.D.**

Location (Give surface location from property or section corner, street center line)

Elevation of ground above sea level
-6'

California Coordinates (if known): **X= 1733221, Y= 573961**

Was the well directionally drilled? ☐ Yes ☒ No If yes, show coordinates at total depth.

Commenced drilling (date)	Total depth			Depth measurements taken from top of:
5/13/07	(1st hole)	(2nd)	(3rd)	☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing
Completed drilling (date) **5/18/07**	**5,500'**			Which is **13** feet above ground

Commenced production/injection (date)	Present effective depth **Plugged & Abndoned**	GEOLOGICAL MARKERS	DEPTH
Production mode: ☐ Flowing ☐ Pumping ☐ Gas lift	Junk **None**		
Name of production/injection zone(s)		Formation and age at total depth **Mokulumne**	Base of fresh water **400'**

	Clean Oil (bbl per day)	API Gravity (clean oil)	Percent Water (including emulsion)	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production						
Production After 30 days						

CASING AND CEMENTING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New (N) or Used (U)	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)	Top(s) of Cement in Annulus
8-5/8"	surface	556'	24#	J-55/ST&C	N	12-1/4	225 sx	Shoe	surface

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforations, and method.)

Logs/surveys run? ☒ Yes ☐ No If yes, list type(s) and depth(s).
Mud log from 3,575'- 5,500'; AIT/BHC Sonic/SP from 5,497'- 556'.

In compliance with Sec. 3215, Division 3, of the *Public Resources Code*, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name	Title	
Princeton Natural Gas, LLC	**Petroleum Engineer**	
Address **34184 Pacific Coast Hwy., Suite C**	City/State **Dana Point, CA**	Zip Code **92629**
Telephone Number **(858) 775-9897**	Signature	Date **6/8/07**

OG100 (1/98/GSR/1M)
Printed on recycled paper.

SUBMIT IN DUPLICATE

DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

HISTORY OF OIL OR GAS WELL

Operator Princeton Natural Gas, LLC Field _____ County San Joaquin

Well "King Island" 33-1 Sec. 33 T. 3N R. 5E M.D. B.&M.

A.P.I. No. 077-20685 Name Irani Engineering Title Petroleum Engineer

(Person submitting report) (President, Secretary, or Agent)

Date 6/8/07
(Month, day, year)

Signature _____

Address 34184 Pacific Coast Hwy, Ste C, Dana Point, CA 92629 Telephone Number (858) 775-9897

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment, with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, and initial production data.

Date
2007

5/13 MIRU Ensign Rig 506. Drilled 12-1/4" hole to 558'. Circulated and wiped hole. POOH. Rigged up power tongs. **8-5/8" casing set at 556'.** Ran 23 joints of 8-5/8", 24.0#, J-55, ST&C new casing including guide shoe, insert and one centralizer. Cemented shoe at 556' with 150 sacks Woodland Lite cement followed with 75 sacks Woodland Tail cement. Cut off casing. Welded casing head and tested it to 2,000 psi. Installed BOE. Function tested BOPE. Made up BHA.

5/14 RIH to 504'. Tested BOPE, witnessed and approved by DOG. Drilled 7-7/8" hole to 2,772', mud weight 9.8 ppg.

5/15 Drilled to 4,578', mud weight 10.0 ppg.

5/16 Drilled to 5,500' TD, mud weight 10.0 ppg. Circulated clean and wiped hole to shoe.

5/17 Circulated and wiped hole from 5,500 to 4,900'. Circulated clean. POOH for E logs. **Schlumberger ran AIT/BHC Sonic/SP from 5,497'-556'.** RIH and laid down HW's and DP. RIH with open-ended drill pipe to 624' for plug & abandonment. **Plug # 1:** Equalized 140 sacks of Class G cement with 3% CaCl2 at 624'.

5/18 Tagged top of cement at 270', approved by DOG. POOH and laid down drill pipe. **Surface Plug:** Cut off wellhead and casing 5' below ground. Set 25 lineal feet top plug. Welded steel plate on stub. Cleaned mud pits. Rig released at 07:00 am.

2007 JUN 11 A11:48

No. T 607-140

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT ON OPERATIONS

District 6

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
June 19, 2007

Your operations at well "King Island" 33-1 **, API No.** 077-20686 .
Sec. 33 **, T.** 3N **, R.** 5E , MD **B. & M.**
Field in San Joaquin **County,**
were witnessed on 5/18/2007 **by** Rich Loverne **, representative of**
the supervisor, was present from 0100 **to** 0200
There was also present
Present condition of the well: 16" cem. 40'; 8 5/8" cem. 556'. TD 5500'. Plugged w/cem. 624' – 270'.

The operations were performed for the purpose of abandonment.

DECISION:

The plugging operations as witnessed and reported are approved.

Note:

SURFACE INSPECTION
Date 12, 20, 07
Engineer JMC/RL

BOND: Blanket

STATUS: Confidential

RSH/lmd

Hal Bopp
State Oil and Gas Supervisor

By Robert S Habel

Deputy Supervisor
Robert S. Habel

OG109 Rev9/01 **(9/89/GSR1/5M)**

T:7-140

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CEMENTING/PLUGGING MEMO

Operator Princeton Natural Energy LLC Well No. Vaca-Tank 33-1

API No. 077-[illegible] Sec. 33, T. 3N, R. 5E, MD B&M

Field _____, County San Joaquin. On 5.18.07

(Mr.) / ~~Ms.~~ R. Lawrence, representative of the supervisor, was present from 0900 to 0200.

There were also present _____

Casing record of well: 16" cem 40'; 8 5/8" cem 556'. TD 5500'. Plugged w/cem 624'-270'.

The operations were performed for the purpose of Abandonment

☒ The ~~plugging~~/~~cementing~~ operations as witnessed and reported are approved.

☐ The location and hardness of the cement plug @ _____' are approved.

Hole size: _____" fr. _____' to _____'; _____" to _____' & _____" to _____'

Casing				Cemented			Top of Fill		Squeezed Away	Final Press.	Perfs.
Size	Wt.	Top	Bottom	Date	MO-Depth	Volume	Annulus	Casing			

Casing/tubing recovered: _____" shot/cut at _____'; _____'; _____' pulled fr. _____';

_____" shot/cut at _____'; _____'; _____' pulled fr. _____'.

Junk (in hole): _____

Hole fluid (bailed to) at _____'. Witnessed by _____

Mudding	Date	bbls.	Displaced	Poured	Fill	Engr.
72/34	5.18.07		Drilling Mud		Santa Fe	R. Lawrence

Cement Plugs		Placing	Placing Witnessed		Top Witnessed			
Date	Sx./cf	MO & Depth	Time	Engr.	Depth	Wt/Sample	Date & Time	Engr.
5.17.07	140sx 165cf	TOC 624'	2045	Pptd A. M.V.	270'	10.2 #	5.18.07 0900	R. Lawrence

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 607-366

PERMIT TO CONDUCT WELL OPERATIONS

000 (field code)
00 (area code)
-- (new pool code)
00 (old pool code)

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
June 18, 2007

Your _____ proposal to Abandon well "King Island" 33-1
A.P.I. No. 07720686, Section 33, T. 3N, R. 5E, MD B.&M.
_____ field, _____ area No Pool Breakdown pool
San Joaquin County, dated 6/8/07, received 6/11/07 has been examined in conjunction with records filed in this office.

THE PROPOSAL, COVERING WORK ALREADY COMPLETED IN ACCORDANCE WITH PRIOR AGREEMENT, IS APPROVED.

Note:

1. All casing must be removed from at least 5 feet below ground level.
2. The cleanup of the wellsite must be approved by the Division before the Report of Final Well Abandonment (OG159) can be issued. ***Please contact this office for site inspection after the wellsite cleanup work has been completed. PURSUANT TO THE CALIFORNIA CODE OF REGULATIONS, WELL SITE RESTORATION MUST BE COMPLETED WITHIN 60 DAYS FOLLOWING PLUGGING AND ABANDONMENT OF THE WELL.***

Blanket Bond

Hal Bopp, State Oil and Gas Supervisor
By Robert S Habel
Robert S. Habel, *Deputy Supervisor*

Engineer Tim Kustic
Phone (916) 322-1110
TK/syh

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

DEPARTMENT OF CONSERVATION
DIV. ...N OF OIL, GAS, AND GEOTHERMAL RESO... ...ES

BOND

Notice of Intention to Abandon Well

OGD114

OGD121

File in Duplicate

In compliance with Section 3229, Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon

Well "King Island" 33-1 API No. 077-20686 Sec. 33 T. 3N R. 5E M.D.B.&M.

Field San Joaquin County, starting work on 5/19/07

The present condition of the well is

1. Total depth: 5,500'

2. Complete casing record, with plugs and perforations (present hole):

Size of Casing	Top of Casing	Depth of Shoe	New	Grade & Type
8-5/8"	Surface	456'	Yes	J-55/ST&C

3. Date last produced or injected: Never Produced, abandoned 5/19/07

Additional data for dry hole (show depths)

1. Oil or gas shows:

2. Stratigraphic markers:

3. Formation and age at total depth:

4. Base of freshwater sands: 400'

Is this a critical well according to the definition on the reverse side of this form (or on page 2 if you are using the Internet)?

☐ Yes ☒ No

The proposed work is as follows: The following work was performed with the prior consent of DOG.
1- Equalized 140 sacks of Class G cement with 3% CaCl2 at 624'. Tagged TOC @ 270', approved by DOG.
2- Set 25 lineal feet surface plug. Cut off head and cap surface casing 5' below ground.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 34184 Pacific Coast Hwy., Suite C (Street)

Dana Point, CA 92629 (City) (State) (Zip)

Telephone Number (858) 775-9897 (Area Code) (Number)

Princeton Natural Gas,LLC (Name of Operator)

By Irani Engineering, Inc. (Print Name)

I. Irani (Signature) 6/8/07 (Date)

OG108 (8/97)

No. T 607-115

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT ON OPERATIONS

District 6

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
June 7, 2007

Your operations at "King Island" 33-1 **, API No.** 077-20686
Sec. 33 **T.** 3N **R.** 5E MD **B. & M.**
Field, in San Joaquin **County**
were witnessed on 5/14/2007 **by** Rich Loverne **representative of**
the supervisor, was present from 0030 **to** 0130
There was also present Matt Vaughn, Company Rep. and Larry Oliver, Tool Pusher
Present condition of the well: 16" cem. 40'; 8-5/8" cem. 556'. TD 556' (Drilling).

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION:
The blowout prevention equipment and its installation on the 8-5/8" casing are approved.

REMARKS AND DEFICIENCIES: Deficiencies noted and corrected: 1) Hydraulic leak @ control valves. Repaired.
Note: Tested Blind Rams to 1500 psi. Logged on Tour.

BOND: Blanket

STATUS: Confidential

RSH/lmd

Hal Bopp
State Oil and Gas Supervisor

By for

Deputy Supervisor
Robert S. Habel

OG109 Rev9/01 **(9/89/GSR1/5M)**

API No. 077-20686 DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES T 7-115

BLOWOUT PREVENTION EQUIPMENT MEMO

Operator Princeton Natural Gas LLC Well "Kings Island" 33-1 Sec. 33 T 3N R 5E

Field — County San Joaquin Spud Date 5/12/07

VISITS:	Date	Engineer	Time	Operator's Rep.	Title
1st	5/12/07	R. Lowrie	(0030 to 0130)	Matt Vaughn	Company Man
2nd			(to)		

Contractor Ensign Rig# 506 Contractor's Rep. & Title Larry Oliver, Tool Pusher

Casing record of well: 16" cem 40'; 8 5/8" cem 556'. TD 556' (Drilling).

OPERATION: Testing (~~inspecting~~) the blowout prevention equipment and installation. Critical well? Y ____ N ____

DECISION: The blowout prevention equipment and its installation on the 8 5/8" " casing are approved.

Proposed Well Opns: Drill. MACP: ____ psi

Hole size: 12 1/4" fr. 40' to 558', ____" to ____' & ____" to ____'

REQUIRED BOPE CLASS: III B 2M

CASING RECORD OF BOPE ANCHOR STRING					Cement Details	Top of Cement	
Size	Weight(s)	Grade(s)	Shoe at	CP at		Casing	Annulus
8 5/8"	24#	J-55	556'		Lead: 150 sx Woodland	5.3'	0'
					Tail: 75 sx "		

BOPSTACK							TEST DATA						
API Symb.	Ram Size (in.)	Manufacturer	Model or Type	Vert. Bore Size (in.)	Press. Rtg.	Date Last Overhaul	Gal. to Close	Recovery Time (Min.)	Calc. GPM Output	psi Drop to Close	Secs. to Close	Test Date	Test Press.
A	CSO	Hydril	GK	11"	3M		6.5					5/14	1000 psi
Rd	4"	Shaffer	E	11"	3M		3.25					5/14	1000 psi
Rd	CSO	Shaffer	E	11"	3M		3.25					—	—
							↓						

TOTAL: 13.0

ACTUATING SYSTEM

Accumulator Unit(s) Working Pressure 3000 psi

Total Rated Pump Output ____ gpm Fluid Level OK

Distance From Well Bore 75 ft.

	Accum. Manufacturer	Capacity	Precharge
1	Koomey	120 gal.	1000 psi
2		gal.	psi

	CONTROL STATIONS	Elec.	Hyd.	Pneu.
X	Manifold at accumulator unit		X	
X	Remote at Driller's station	X		
	Other:			

	EMERG. BACKUP SYSTEM			Press.	Wkg. Fluid
X	N_2 Cylinders	1	L=51"	2000	5.0 gal.
	Other:	2	L=51"	2200	6.0 gal.
		3	L=51"	2500	8.0 gal.
		4	L= "		gal.
		5	L= "		gal.
		6	L= "		gal.
				TOTAL:	19.0 gal.

AUXILIARY EQUIPMENT

		No.	Size (in.)	Rated Press.	Connections: Weld	Flange	Thread	Test Press.
X	Fill-up Line							
X	Kill Line		2"	2M	X	X	X	1000 psi
X	Control Valve(s)	2				X		
X	Check Valve(s)					X		
X	Aux. Pump Connect.						X	
X	Choke Line		3"		X	X	X	
X	Control Valve(s)	10				X		
X	Pressure Gauge					X		
X	Adjustable Choke(s)	2	3"			X		
X	Bleed Line				X	X	X	
X	Upper Kelly Cock							
X	Lower Kelly Cock		4"					
X	Standpipe Valve							
X	Standpipe Press. Gauge							↓
X	Pipe Safety Valve		4"					—
X	Internal Preventer		4"	↓				—

	HOLE FLUID MONITORING EQUIPMENT	Alarm Type: Audible	Visual	Class
X	Calibrated Mud Pit	X	X	A
X	Pit Level Indicator	X	X	B
X	Pump Stroke Counter	X	X	
	Pit Level Recorder			C
	Flow Sensor			
	Mud Totalizer			
	Calibrated Trip Tank			
	Other:			

Hole Fluid Type	Weight	Storage Pits (Type & Size)
Mud	9.0	200 bbls

REMARKS AND DEFICIENCIES:

① Hydraulic Leak ② Control Valves Repaired

Note: Tested Blind Rams to 1500 psi Logged on Tour

OGD9 (4/03/UCP/3M)

5/17/07

Tim Kustic – Saeed

RE: Princton "King Island" 33-1

No shows will P&A. TD 5500. BFW~400 8 5/8 556'

Will place ~450' plug from 606±. For BFW and shoe

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 607-287

PERMIT TO CONDUCT WELL OPERATIONS

000 (field code)

Well Classification: Exploratory - Outpost

00 (area code)

00 (new pool code)

-- (old pool code)

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
May 4, 2007

Your _____ proposal to Drill well "King Island" 33-1
A.P.I. No. 07720686, Section 33, T. 3N, R. 5E, MD B.&M.
_____ field, _____ area No Pool Breakdown pool
San Joaquin County, dated 5/4/07, received 5/4/07 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing proposed to be set at 550' is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 4 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity is used to control all subsurface conditions to prevent blowouts.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. **THIS DIVISION IS NOTIFIED:**
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.
   c. Promptly, in the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks.

NOTE:

1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 400'±. A final determination must be made from the well logs after the well is drilled.
2. **This well has been granted confidential status for two years from the cessation of drilling operations.**

WHEN THE WELL HAS BEEN SPUDDED, PLEASE CONTACT THIS OFFICE DURING DAYLIGHT HOURS (8AM TO 5PM) AT (916) 322-1110.

Enclosures (3)

TK/syh
Lat: 38.072806765 Long: -121.426348767
Engineer Tim Kustic
Phone (916) 322-1110

Hal Bopp, State Oil and Gas Supervisor
By T R Kustic for
Robert S. Habel, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

NOTICE OF INTENTION TO DRILL NEW WELL

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS ____	NEG. DEC. ☐ S.C.H. NO.	E.I.R. ☐ S.C.H. NO.	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☒
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
		187			

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well King Island No. 33-1, well type ____, API No. ____ (Assigned by Division).

Sec. 33, T. 3N, R. 5E, MD B.&M., Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 320 acres (attach map or plat to scale), is as follows:
Comprising in part NE/4 of sec. 33 and SE/4 of Sec. 28.
Confidential Status Requested.

Do mineral and surface leases coincide? Yes ☐ No ☐. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well X=1733221 feet ____ (Direction) along section ☒ / property ☐ (Check one) line and Y=573961 feet ____ (Direction)

at right angles to said line from the ____ corner of section ☒ / property ☐ (Check one) ____ or

Is this a critical well according to the definition on the next page of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) and true vertical depth at total drilled depth:
____ feet ____ (Direction) and ____ feet ____ (Direction) Estimated true vertical depth 5500. Elevation of ground above sea level ____ feet. All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table, or Kelly Bushing) that is 13 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
8-5/8"	24#	J-55, ERW	Surface	550'	550'	500'
4-1/2"	10.5#	J-55, ERW	Surface	5500'	5500'	CP at fresh

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Mokulumne, 5200', 2250 psig (Name, depth, and expected pressure) Estimated total depth 5500' (Feet)

It is understood that if changes to this plan become necessary, we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
Princeton Natural Gas, LLC	LLC	
Address 34184 Pacific Coast Hwy, Suite C	**City** Dana Point, CA	**Zip Code** 92629
Telephone Number 858-775-9897 / **Name of Person Filing Notice** A. Irani	**Signature**	**Date** 5/4/07

This notice and an indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

OG108 (5/00)

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice or supply the following information:

Lead Agency: San Joaquin County

Lead Agency Contact Person: Chuck Ferrano

Address: 1810 E. Hazelton Ave.

Stockton, CA 95205-6232

Phone: (209 468-3121

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks:

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720 (a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 606-414

PERMIT TO CONDUCT WELL OPERATIONS

000 (field code)
00 (area code)
00 (new pool code)
-- (old pool code)

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
August 25, 2006

Your Supplementary proposal to Drill well "King Island" 33-1
A.P.I. No. 07720686, Section 33, T. 3N, R. 5E, MD B.&M.
field, area No Pool Breakdown pool
San Joaquin County, dated 8/21/06, received 8/25/06 has been examined in conjunction with records filed in this office.

THE PROPOSAL TO EXTEND PERMIT NO. 605-206 UNTIL MAY 3, 2007 IS APPROVED PROVIDED THAT IN ALL OTHER RESPECTS THE WELL SHALL BE DRILLED IN ACCORDANCE WITH THE PROVISIONS SET FORTH IN PERMIT NO. 605-206, DATED MAY 3, 2007.

Cancelled TM 5/4/07

Bond: 6-755

Hal Bopp, State Oil and Gas Supervisor
By Robert S. Habel
Robert S. Habel, *Deputy Supervisor*

Engineer Tim Kustic
Phone (916) 322-1110
TK/syh

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

FOR DIVISION USE ONLY		
	Forms	
Bond	OGD114	OGD121
6-14	414	

SUPPLEMENTARY NOTICE

A notice to the Division of Oil, Gas, and Geothermal Resources, *dated* 8-21-06, stating the intention to

DRILL (*Drill, rework, abandon*) well KING ISLAND 33-1 (*Well designation*), API No. 07720686,

Sec. 33, T. 3-N, R. 5-E, MD B.&M., KING ISLAND Field,

SAN JOAQUIN County, should be amended because of changed conditions.

1. The complete casing record of the well (present hole), including plugs and perforations, is as follows:

SEE ATTACHED PERMIT. WE ARE SEEKING TO RENEW. BOND IS IN PLACE. WE ARE WAITING ON A RIG.

2. The total depth is: 5500 feet. The effective depth is: 5500 feet.

3. Present completion zone (s): N/A (*Name*). Anticipated completion zone (s): M RIVER (*Name*).

4. Present zone pressure: _____ psi. Anticipated/existing new zone pressure: _____ psi.

We now propose: *(A complete program is preferred and may be attached.)*

PERMIT EXTENSION (SEE ATTACHED) BOND IN PLACE

2006 AUG 25 PM 1:10

Note: If the well is to be redrilled, show proposed bottom-hole coordinates and estimated true vertical depth.
The Division must be notified if changes to this plan become necessary.

Name of Operator	Telephone Number	
PRINCETON NATURAL GAS LLC	858-275-9897	
Address: 34184 PCH "C" ~~DANA PT CA~~	City: DANA POINT	Zip Code: 92629
Name of Person Filing Notice: PATRICK ROSS	Signature	Date: 8-21-06

OG123 (8/97)

File In Duplicate

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 605-206

2005 AUG 25 PM 1:11

PERMIT TO CONDUCT WELL OPERATIONS

000 (field code)

Well Classification: Exploratory - Outpost

00 (area code)

00 (new pool code)

-- (old pool code)

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
May 3, 2005

Your _____ proposal to Drill well "King Island" 33-1
A.P.I. No. 07720686 . Section 33 , T. 3N , R. 5E , MD B.&M.
_____ field, _____ area No Pool Breakdown pool
San Joaquin County, dated 3/28/05 , received 4/7/05 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing proposed to be set at 725' is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 4 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity is used to control all subsurface conditions to prevent blowouts.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. **THIS DIVISION IS NOTIFIED:**
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.
   c. Promptly, in the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks.

NOTE:

1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 400'±. A final determination must be made from the well logs after the well is drilled.
2. **This well has been granted confidential status for two years from the cessation of drilling operations.**

WHEN THE WELL HAS BEEN SPUDDED, PLEASE CONTACT THIS OFFICE DURING DAYLIGHT HOURS (8AM TO 5PM) AT (916) 322-1110.

Enclosures (3)
Bond: 6-755
TK/syh
Lat: 38.07278 Long: -121.42752
Engineer Tim Kustic
Phone (916) 322-1110

Hal Bopp, State Oil and Gas Supervisor
By Robert S Habel
Robert S. Habel, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

FOR DIVISION USE ONLY		
	Forms	
Bond	OGD114	OGD121

SUPPLEMENTARY NOTICE

A notice to the Division of Oil, Gas, and Geothermal Resources, *dated* 8-21-06, stating the intention to

DRILL (Drill, rework, abandon) well KING ISLAND 33-1 (Well designation), API No. 07720686,

Sec. 33, T. 3-N, R. 5-E, MD B.&M., KING ISLAND Field,

SAN JOAQUIN County, should be amended because of changed conditions.

1. The complete casing record of the well (present hole), including plugs and perforations, is as follows:

SEE ATTACHED PERMIT. WE ARE SEEKING TO RENEW. BOND IS IN PLACE. WE ARE WAITING ON A RIG.

2. The total depth is: 5500 feet. The effective depth is: 5500 feet.

3. Present completion zone (s): N/A (Name). Anticipated completion zone (s): M RIVER (Name).

4. Present zone pressure: _____ psi. Anticipated/existing new zone pressure: _____ psi.

We now propose: *(A complete program is preferred and may be attached.)*

PERMIT EXTENSION (SEE ATTACHED) BOND IN PLACE

OIL, GAS & GEOTHERMAL RES
2005 AUG 25 PM 1:10
RECEIVED

Note: If the well is to be redrilled, show proposed bottom-hole coordinates and estimated true vertical depth.
The Division must be notified if changes to this plan become necessary.

Name of Operator	Telephone Number	
PRINCETON NATURAL GAS LLC	858-775-9897	
Address: 34184 PCH "C" ~~DANA PT. CA~~	City: DANA POINT	Zip Code: 92629
Name of Person Filing Notice: PATRICK ROSS	Signature	Date: 8-21-06

OG123 (8/97)

File in Duplicate

DOG Communication Log

Well Name: "King Island" 33-1
API# 077-20686

County: San Joaquin Co. Field:

Location: Sec. 33 T. 3N R. 5E

Staff: pmc Date: 6/21/06

Person(s): Pat Ross

Company/Agency: Princeton Natural Gas, LLC

Phone: 858-775-9897

Summary: He called about the surface cleanup of this drill pad. The permit was cancelled and he doesn't think he should have to clean up the site before his bond could be released. I explained to him the requirement of the regulations/law – he said that Aspen wants to drill at this site – I told him that once he legally transfers the responsibility to Aspen – then we will release his bond and take him off the attachment to the site. I explained the process that Aspen and he would have to do.

He then stated that the landowner doesn't mind the pad – I told him that he would have to get rid of the conductor and still have a letter of acceptance by the landowner.

DOG Communication Log

Well Name: "King Island" 33-1
API# 077-20686

County: San Joaquin Co. Field:

Location: Sec. 33 T. 3N R. 5E

Staff: pmc Date: 6/21/06

Person(s): Pat Ross

Company/Agency: Princeton Natural Gas, LLC

Phone: 858-775-9897

Summary: He called about the surface cleanup of this drill pad. The permit was cancelled and he doesn't think he should have to clean up the site before his bond could be released. I explained to him the requirement of the regulations/law – he said that Aspen wants to drill at this site – I told him that once he legally transfers the responsibility to Aspen – then we will release his bond and take him off the attachment to the site. I explained the process that Aspen and he would have to do.

He then stated that the landowner doesn't mind the pad – I told him that he would have to get rid of the conductor and still have a letter of acceptance by the landowner.


07720686 33/3N/5E
Princeton Natural Gas, LLC
King Island 33-1
38.07281
-121.42635
Cancelled
20060619
* SUMP ON NW CORNER OF FIELD 6/9/06
South Mokelumne River
N Rio Blanco Rd
W Eight Mile Rd
STOCKTON
I-5

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF CORRECTION OR CANCELLATION

Sacramento, California

June 6, 2006

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Ste. C
Dana Point, CA 92629

In accordance with **Section 3203 of the Public Resources Code**
the following change pertaining to your well **"King Island" 33-1 (API # 077-20686)** ,
field, San Joaquin County,
Sec. 33 , T. 3N , R. 5E , M.D. B.&M., is being made to our records:

☐ The corrected location is

☐ The corrected elevation is

☐ Report No. , dated ,has been
corrected as follows:

☒ Your notice to **Drill** dated **5/3/05** ,
(Drill, abandon, etc.)
and our report **#P605-206** , issued in answer thereto, are hereby **cancelled**, in-as-much as the work was not done within one year of issuance of the permit. If you have an individual bond on file covering this notice, it will be returned. No request for such return is necessary.

☐ Other:

Hal Bopp
State Oil and Gas Supervisor

By Robert S Habel
Robert S. Habel
Deputy Supervisor

RSH/

OG165

Copy.

Princeton Natural Gas, LLC

34184 "C" Pacific Coast Highway
Dana Point, California 92629

Phone & Fax: 949.443.9900

May 30, 2006

OIL-GAS-GEOTH RES
RECEIVED-SACRAMENTO
2006 JUN -2 PM 1:00

Mr. Robert Habel, Deputy Supervisor
Division Of Oil, Gas, and Geothermal Resources
801 K Street
MS 20-22
Sacramento, California 95814

Re: Cancel Drilling Permit # P605-206, King Island 33-1

Dear Mr. Habel:

Please cancel Permit To Conduct Well Operations (copy attached). Well name "King Island 33-1", A.P.I. number 07720686, Section 33, T. 3N, R. 5E, MD B.& M., San Joaquin, County, California, received by your office on 4/07/05. Permit dated May 3, 2005.

Also, please cancel the cash bond and sent refund check made out to: Princeton Natural, LLC 34184 Pacific Coast Highway Suite "C", Dana Point, California 92629. Thank you in advance for your attention to this matter.

Sincerely,

Patrick Ross

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 605-206

OIL-GAS-GEOTH RES
RECEIVED-SACRAMENTO
2006 JUN -2 PM 1:00

PERMIT TO CONDUCT WELL OPERATIONS

Well Classification: Exploratory - Outpost

000 (field code)
00 (area code)
00 (new pool code)
-- (old pool code)

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
May 3, 2005

Your _____ proposal to Drill well "King Island" 33-1
A.P.I. No. 07720686, Section 33, T. 3N, R. 5E, MD B.&M.
_____ field, _____ area No Pool Breakdown pool
San Joaquin County, dated 3/28/05, received 4/7/05 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing proposed to be set at 725' is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 4 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity is used to control all subsurface conditions to prevent blowouts.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. **THIS DIVISION IS NOTIFIED:**
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.
   c. Promptly, in the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks.

NOTE:

1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 400'±. A final determination must be made from the well logs after the well is drilled.
2. **This well has been granted confidential status for two years from the cessation of drilling operations.**

WHEN THE WELL HAS BEEN SPUDDED, PLEASE CONTACT THIS OFFICE DURING DAYLIGHT HOURS (8AM TO 5PM) AT (916) 322-1110.

Enclosures (3)
Bond: 6-755
TK/syh
Lat: 38.07278 Long: -121.42752
Engineer Tim Kustic
Phone (916) 322-1110

Hal Bopp, State Oil and Gas Supervisor
By Robert S Habel
Robert S. Habel, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 605-206

PERMIT TO CONDUCT WELL OPERATIONS

000 (field code)
00 (area code)
00 (new pool code)
-- (old pool code)

Well Classification: Exploratory - Outpost

Patrick Ross, Agent
PRINCETON NATURAL GAS, LLC
34184 Pacific Coast Hwy., Suite C
Dana Point, CA 92629

Sacramento, California
May 3, 2005

Your _____ proposal to Drill well "King Island" 33-1
A.P.I. No. 07720686, Section 33, T. 3N, R. 5E, MD B.&M.
_____ field, _____ area No Pool Breakdown pool
San Joaquin County, dated 3/28/05, received 4/7/05 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing proposed to be set at 725' is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 4 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity is used to control all subsurface conditions to prevent blowouts.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 4 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. **THIS DIVISION IS NOTIFIED:**
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.
   c. Promptly, in the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks.

NOTE:

1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 400'±. A final determination must be made from the well logs after the well is drilled.
2. **This well has been granted confidential status for two years from the cessation of drilling operations.**

WHEN THE WELL HAS BEEN SPUDDED, PLEASE CONTACT THIS OFFICE DURING DAYLIGHT HOURS (8AM TO 5PM) AT (916) 322-1110.

Enclosures (3)
Bond: 6-755
TK/syh
Lat: 38.07278 Long: -121.42752
Engineer Tim Kustic
Phone (916) 322-1110

Hal Bopp, State Oil and Gas Supervisor
By Robert S Habel
Robert S. Habel, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

* BOND RECEIVED ON APRIL 26, 2005

4/11/05 TK/Pat Ross will work on bond. Please hold. 5/2/05 PR New Form sent

Div. of Oil & Gas - Dist. 6
RECEIVED
APR 07 2005 *
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

NOTICE OF INTENTION TO DRILL NEW WELL

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS	NEG. DEC. ☐ S.C.H. NO.	E.I.R. ☐ S.C.H. NO.	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☐
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
610	TK 5/2/05	605-206	6-755		

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well King Island 33-1, well type Gas, API No. 077-20686 (Assigned by Division)

Sec. 33, T. 3N, R. 5E, MD B.&M., ~~King Island~~ Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 1215 acres (attach map or plat to scale), is as follows:
East 1/2 of Section 33 of T-3-N R-5-E San Joaquin County, California

also 1/2 of Sec. 28 TK/Patrick Ross 5/2/05

EXOP BFW ~ 400

* Do mineral and surface leases coincide? Yes ☐ No ☒. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 1054 feet West (Direction) along section ☒ / property ☐ (Check one) line and 36 feet South (Direction)

at right angles to said line from the ~~SE~~ N corner of section ☒ / property ☐ (Check one) ~~28~~ 33 or

38.07278
-121.42752

Is this a critical well according to the definition on the next page of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) and true vertical depth at total drilled depth: ____ feet ____ (Direction) and ____ feet ____ (Direction) Estimated true vertical depth ____. Elevation of ground above sea level -6 feet. All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table, or Kelly Bushing) that is 12 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
8 5/8"	24#	J-55	Surface	725'	725'	372 Sacks 578CF
4 1/2"	10.5#	K-55	Surface	5500'	500 feet	above upper zone

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Mokelumne River (Name, depth, and expected pressure) Estimated total depth 6,000' (Feet)

It is understood that if changes to this plan become necessary, we are to notify you immediately.

Name of Operator		Type of Organization (Corporation, Partnership, Individual, etc.)	
Princeton Natural Gas		LLC	
Address: 34184 "C" PCH		City: Dana Point, California	Zip Code: 92629
Telephone Number: 858.775.9897	Name of Person Filing Notice: Patrick Ross	Signature: [signature]	Date: 3/28/2005

This notice and an indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

4-27-05
* Patrick Ross called wanting BFW. DOG picked ~ 400'

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: _____

Lead Agency Contact Person: _____

Address: _____

_____

Phone: ( ) _____

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks: _____
_____
_____

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720 (a), "Critical well" means a well within:

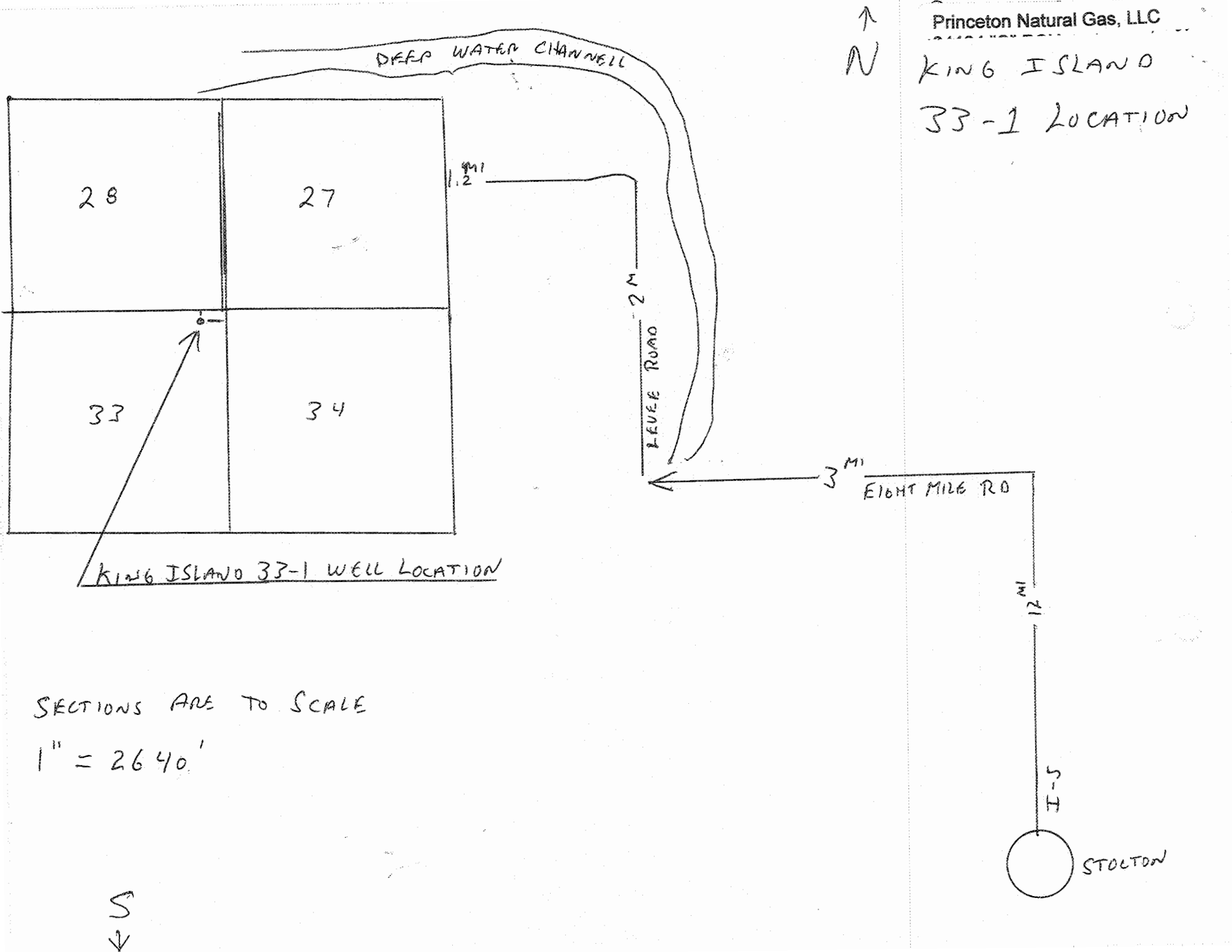
(1) 300 feet of the following:
  (A) Any building intended for human occupancy that is not necessary to the operation of the well; or
  (B) Any airport runway.
(2) 100 feet of the following:
  (A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
  (B) Any navigable body of water or watercourse perennially covered by water;
  (C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
  (D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

077-20484

Princeton Natural Gas, LLC

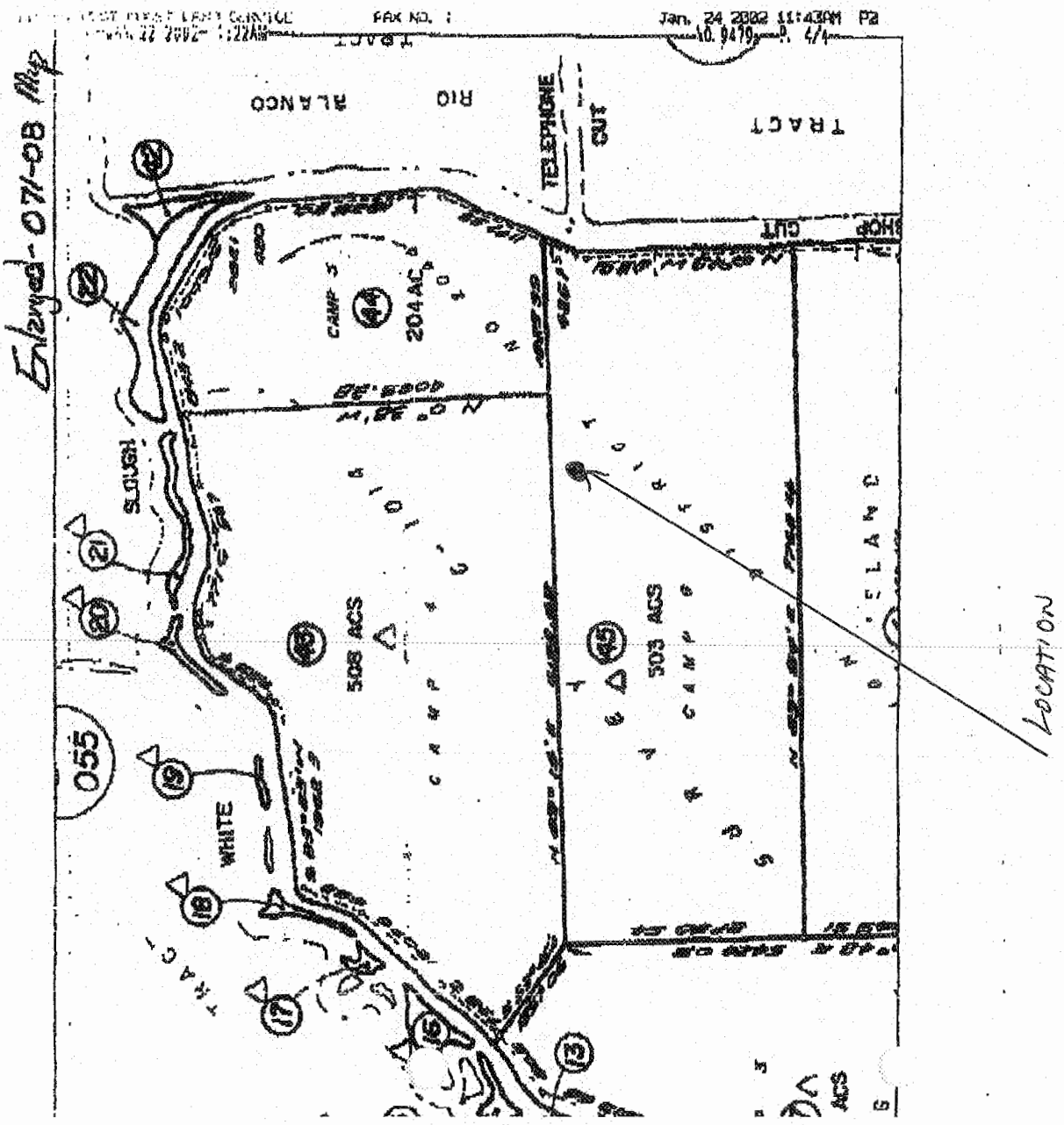
KING ISLAND 33-1 LOCATION



SECTIONS ARE TO SCALE

1" = 2640'

S


Enlarged-07-08 Map
Jan. 24 2002 11:43AM P2
TRACT
RIO BLANCO
TELEPHONE CUT
CAMP 3
204 ACS
SLOUGH
508 ACS
503 ACS
WHITE
055
LOCATION

See Map 23-3

CACHE SLOUGH, EAST ISLANDS
KING ISLAND, LINDSEY SLOUGH
RIO VISTA, RIVER ISLAND
SHERMAN ISLAND
W.THORNTON-WALNUT GROVE

CONTRA COSTA, SAN JOAQUIN, SOLANO CO. CALIF.
SCALE 1" = 6000'

See Map W-18

See Map 25

T4N R4E

T4N R5E

T3N R4E

T3N R5E

RIVER ISLAND GAS

STATEN ISLAND

BOULDIN ISLAND

EAST ISLANDS GAS

KING ISLAND GAS

SAN JOA

COUNTY

PACIFIC

WESTERN

SOUTHERN

Sherman Island

Sherman Island

Sherman Island

SAN JOAQUIN COUNTY
COMMUNITY DEVELOPMENT DEPARTMENT

1810 E. HAZELTON AVE., STOCKTON, CA 95205-6232
PHONE: 209/468-3121 FAX: 209/468-3163

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 02 2005
Sacramento, California

March 23, 2005

State of California
Dept Conservation - Administration
801 K Street, #Flr-24
Sacramento, CA 95814-3528

Gentlemen:

RE: IMPROVEMENT PLAN NUMBER: PA-0500106 APN: 071-080-43

On FEBRUARY 22, 2005, the San Joaquin County Community Development Department approved an Application No. PA-0500106 to drill for gas and/or oil on property located approximately 5400' north of Eight Mile Road, 1700; south of White Slouth, 500' west of Bishop Cut, on Camp #4 in Township 3 North, Route 5 East, Section 28 M.D.M., San Joaquin County.

TC/PR will change w/county 5/2/05

The property is owned by Raymond & J. Moresco Trs., the applicant was Princeton Natural Gas, LLC.

Improvement plans are processed as ministerial projects by San Joaquin County.

If you have any questions, please do not hesitate to contact this office.

Sincerely,

CHUCK FARANO
Counter Manager

CF:gjt
Attachments: Conditions of Approval & Map

cc: Environmental Health Division
Building Inspection Division
Raymond & J. Moresco Trs.
Department of Public Works
Bureau of Fire Prevention
Princeton Natural Gas, LLC

Div. of Oil & Gas - L 6
RECEIVED
MAY 0 2 2005
Sacramento, California

FIRE PERMIT

SAN JOAQUIN COUNTY COMMUNITY DEVELOPMENT DEPARTMENT
1810 E HAZELTON AVENUE, STOCKTON CA 95205
BUSINESS PHONE (209) 468-3380

SITE LOCATION INFORMATION

Job Site Address: 8751 W EIGHT MILE RD STOC

Cross St:

Scope of Work: REQUIRED FIRE PERMIT FOR NATURAL GAS WELL

PERMIT NUMBER

FP-0500131

APN: 071-080-43

OWNER NAME AND ADDRESS

NAME: MORESCO, RAYMOND & J TRS
ADDRESS: 29 BANBURY
STOCKTON CA

Zip: 95207- Phone:

APPLICANT NAME AND ADDRESS

NAME: PRINCETON NATURAL GAS,LLC
ADDRESS: 34184 PACIFIC COST HWY SUITE C
DANA POINT, CA

Zip: 92629 Phone: 858 775-9897

CONTRACTOR INFORMATION

NAME:
ADDRESS:

Lic. No.: Phone:

DESIGNER INFORMATION

PERMIT DESCRIPTION
THIS PERMIT MUST, AT ALL TIMES, BE KEPT ON THE PREMISES

1058F35 FUEL DISP STA, INSTALL O

Permit Expires: 04/13/2006

This permit does not take the place of any License required by law and is not transferable. Any changes in use or occupancy of premises shall require a new permit. This permit shall, in no way, relieve the party to whom it is issued from full responsibility for damages incurred through its use.

FIRE PERMIT INFORMATION

Total Sq. Ft.: 0	Occupancy:	Const. Type:	Fee: $95.00
Accepted By: KB	Approved:	Applied Date: 03/24/2005	Issue Date: 04/18/2005

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 02 2005
Sacramento, California

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

BOND NO. 6-755

INDIVIDUAL OIL AND GAS WELL CASH BOND

Public Resources Code Sections 3202(e), 3204, 3205.5, and 3207

(INSTRUCTIONS ON REVERSE SIDE)

Know All Persons by These Presents:
That PRINCETON NATURAL GAS, LLC
(or) (Partners or Corporation)
That I, _____ (Individual)

as principal, having an address for service of 34184 "C" PCH, DANA PT. CA. 92629
present a total cash deposit of TWENTY THOUSAND AND NO/100 DOLLARS
($ 20,000.00) in the form of:

Cashiers Check No. 03086 02315, in the amount of $ 20,000.00 ;and/or
Certified Check No. _____, in the amount of $ _____ ;and/or
Certificate of Deposit No. _____, in the amount of $ _____ ;and/or
Passbook Account No. _____, in the amount of $ _____ ,

made payable solely or assigned solely to the Department of Conservation, Division of Oil, Gas, and Geothermal Resources.

WHEREAS, said principal is about to acquire, drill, redrill, deepen, or permanently alter an oil or gas well in CALIFORNIA designated as KING ISLAND 33-1 Well,

and is located in Sec. 33, T. 3N, R. 5E, M.D. (M.D., S.B., or H.) B.&M., and, in lieu of an indemnity bond,

is filing this cash bond in accordance with Sections 3202(e), 3204, 3205.5, and/or 3207 of the California Public Resources Code.

NOW, THEREFORE, the conditions of the foregoing obligation are that if the principal shall comply with all the provisions of Division 3 (commencing with Section 3000) of the Public Resources Code and shall obey all lawful orders of the State Oil and Gas Supervisor or district deputy, subject to subsequent appeal as provided in Division 3, and shall pay all charges, costs, and expenses incurred by the Supervisor or district deputy with respect to the well and attendant facilities of the principal, in pursuance of the provisions of Division 3, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Principal hereby authorizes the Department of Conservation, Division of Oil, Gas, and Geothermal Resources, to collect or otherwise apply the total cash deposit presented herein to enforce the liability of the principal on the deposit.

This bond may be cancelled only in accordance with the provisions of Section 3207 of the Public Resources Code. This bond is furnished to comply with the provisions of Division 3, Chapter 1 of the Public Resources Code and of Chapter 2, Title 14, Part 2 of the Code of Civil Procedure and is subject to the terms and provisions thereof.

This is to certify under penalty of perjury that the above cash deposit is free of all liens, including tax liens.

Executed at DANA POINT CALIFORNIA (City and State), on 4/27/05 (Date).

[Principal] PRINCETON NATURAL GAS, LLC

By: _____ (Signature)

PATRICK ROSS (Printed or typed name)

PRESIDENT (Title)

(SEAL OF PRINCIPAL)

APPROVED BY: Hal Bopp, State Oil and Gas Supervisor

By: Robert S Habel (Signature), Deputy

Date May 2, 2005

OG160C (12/03/GSR/3M)

2DIL1

SCHLUMBERGER INDUCTION - ELECTRICAL LOG

COUNTY
FIELD or LOCATION
WELL
COMPANY

COMPANY W. W. Holmes, Operator

WELL "Klein" 1-28 (077-00510)

FIELD ~~King Island~~ King Island

LOCATION 28-3N-5E 7

COUNTY San Joaquin

STATE California

Other Surveys

Location of Well
2200' W & 2100' S from NE corner projected Sect. 28-3N-5E MDB & M

Elevation: K.B.: +9.5
D.F.:
or G.L.: -4'

FILING No.

RUN No.	-1-				
Date	6-18-61				
First Reading	5697				
Last Reading	497				
Feet Measured	5200				
Csg. Schlum.	497				
Csg. Driller	496				
Depth Reached	5703				
Bottom Driller	5702				
Depth Datum	KB				
Mud Nat.	CLAY				
Dens. Visc.	80 47				
Mud Resist.	2.9 @ 88 °F	@ °F	@ °F	@ °F	@ °F
" Res. BHT	2.0 @ 129 °F	@ °F	@ °F	@ °F	@ °F
Rmf c	1.75 @ 129 °F	@ °F	@ °F	@ °F	@ °F
Rmc c	1.7 @ 129 °F	@ °F	@ °F	@ °F	@ °F
" pH	8.0 @ 88 °F	@ °F	@ °F	@ °F	@ °F
" Wtr. Loss	8.2 CC 30 min.	CC 30 min.	CC 30 min.	CC 30 min.	CC 30 min.
Bit Size	6 1/4"				
Spcgs.—AM	16"				
MN	27'2"				
IND.	5FF40				
Opr. Rig Time	2hrs.				
Truck No.	1510				
Recorded By	Marchette				
Witness	Holmes				

DIVISION OF OIL AND GAS
RECEIVED
JUL 12 1961
WOODLAND, CALIFORNIA

FOLD HERE

REMARKS C.D. Not Used ; S.O. = 0

Cartridge No. IRC-D 816
Panel No. IRP-B 197
Sonde No. IRS-C 413

CONDUCTIVITY millimhos/m = 1000/ohms. m²/m

INDUCTION 1000

RESISTIVITY ohms. m²/m

16" NORMAL — Amp Nor — 6 — 0 — 30 — 0 — 300 — 0

INDUCTION — 30 — 0 — 300 — 0

DEPTHS

SPONTANEOUS-POTENTIAL millivolts

10 — +



0600
0700
0800
0900
1000
1100
1200

1300
1400
1500
1600
1700
1800
1900


2000
2100
2200
2300
2400
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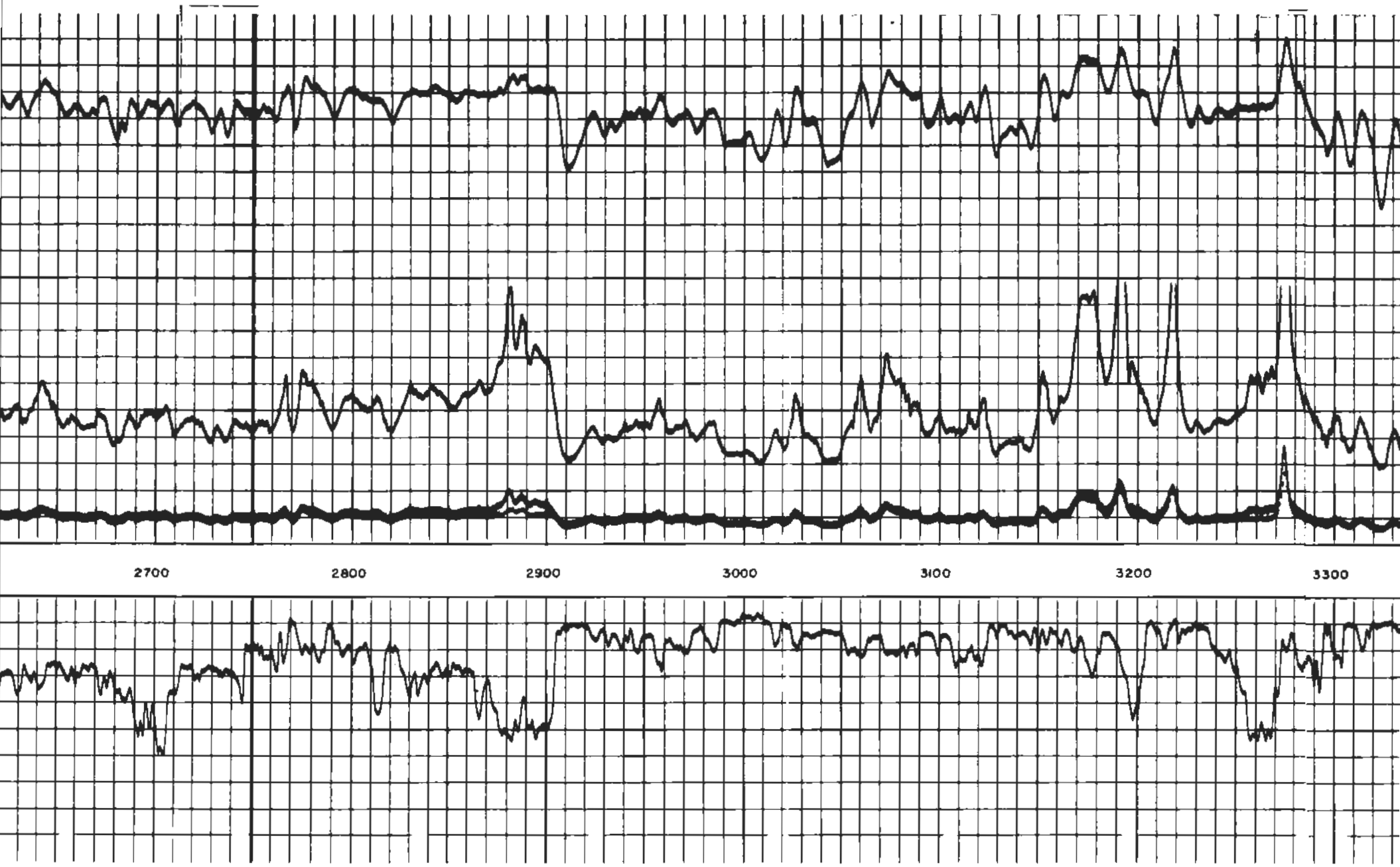
2600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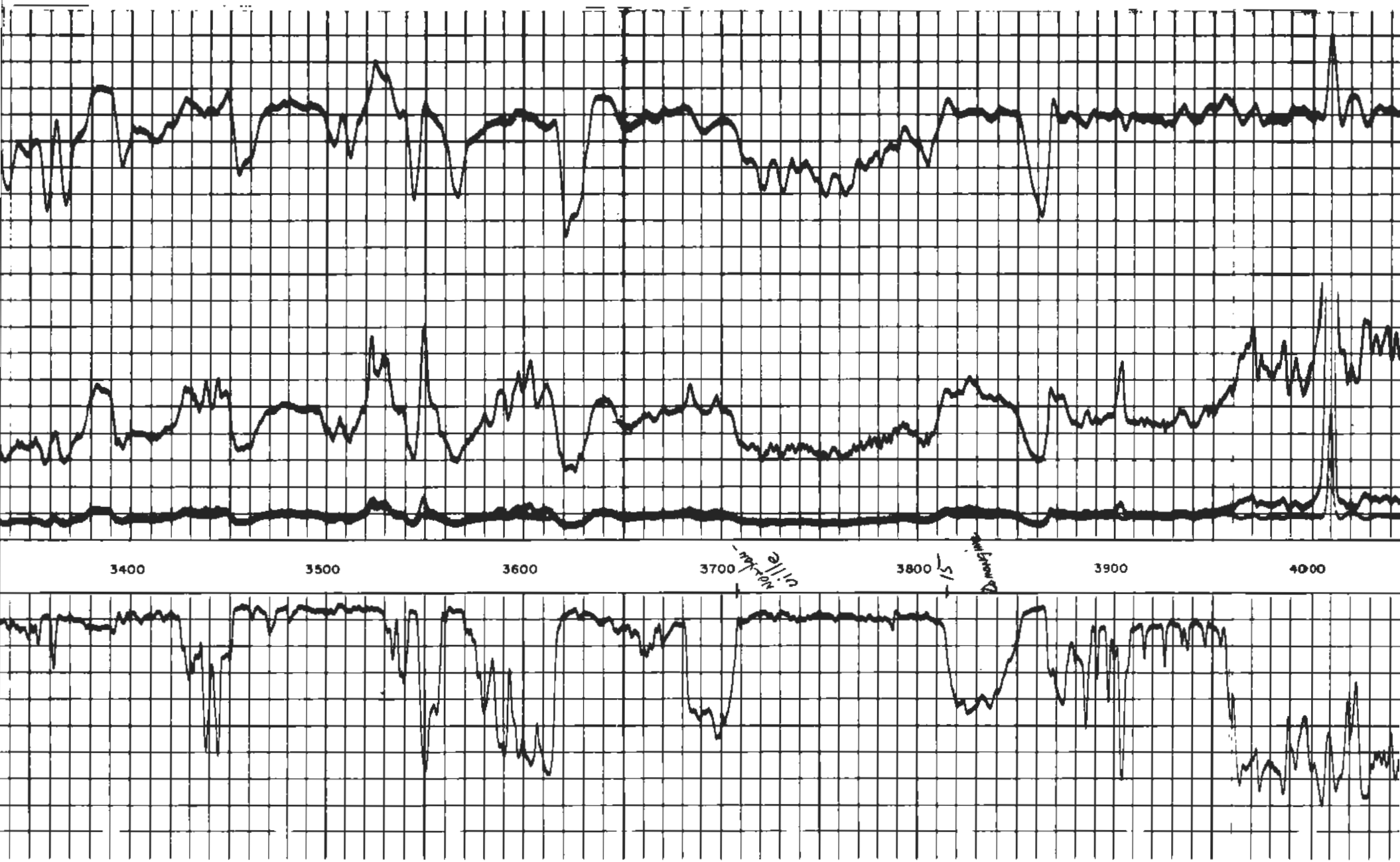
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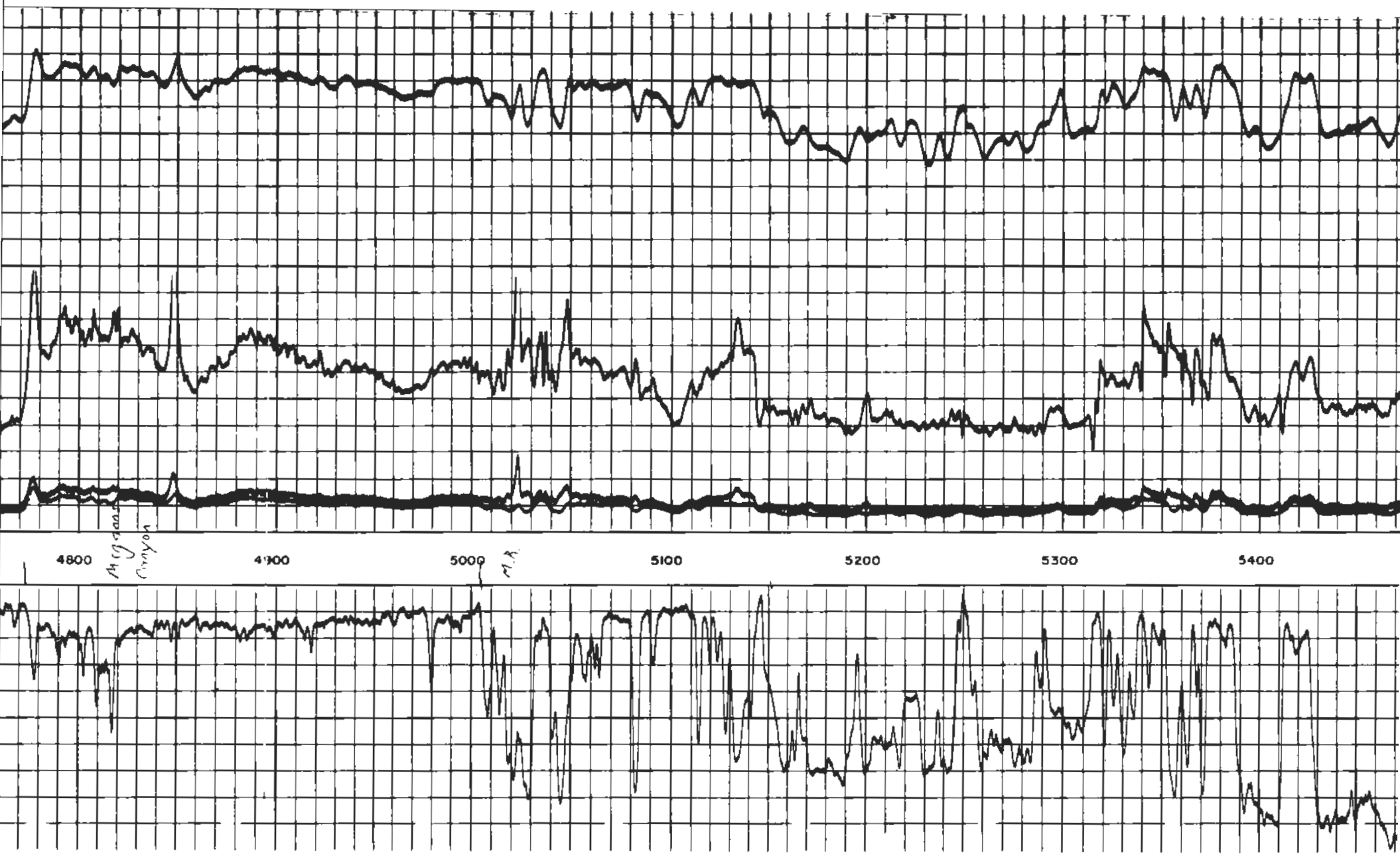

4800
4900
5000
5100
5200
5300
5400

5500
5600

FORM 159 (9-49)

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL AND GAS

23

REPORT OF WELL ABANDONMENT

Woodland, California

July 26, 1961

Mr. W. W. Holmes
P. O. Box 301
Merced, California
Agent for W. W. HOLMES, OPERATOR

DEAR SIR:

017 00510

Your report of abandonment of Well No. "Klein" 1-28,
Sec. 28, T. 3 N., R. 5 E., M.D. B. & M., --- field,
San Joaquin County, dated June 26, 1961, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

FEK:mjj

E. H. MUSSER
State Oil and Gas Supervisor

By F. E. Kasline
Deputy Supervisor

20237 5-60 10M SPO

OK

MAP & BOOK

FEK

STATUS

Completed Producing _____
Recompleted Producing _____
Completed Abandoned ✓
Uncompleted Abandoned ✓
Idle _____

RECORDS

Received		Needed
✓	Well Summary	
✓	History	
✓	Log & Core	
✓ Lge ___ Sm	Elec. Log(s) ___ Lge ___ Sm	
	Direct. Survey	
✓ Donic	Other	

Location OK
Elevation OK
Release Bond [illegible]
Hold Bond ___ Reason
Final letter [illegible] 7-26-61
150b ✓ 7-26-61
170 ✓
121 ✓
card

7/19/61
FEK

Form 19

FORM 100
CALIFORNIA STATE PRINTING OFFICE

SUBMIT LOG IN DUPLICATE
FILL THIS BLANK IN WITH TYPEWRITER. WRITE ON ONE SIDE OF PAPER ONLY

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

Operator W.W. Holmes Field King Island

Well No. "Klein" 1-28 Sec. 28, T. 3N., R. 5E., MD B. & M.

Location 2200' W. and 2100' S. from N.E. Corner projected section 28-3N-5E

Elevation of ground above sea level -4 feet.

All depth measurements taken from top of K.B., which is 13.5 feet above ground.

In compliance with the provisions of Chapter 93, Statutes of 1939, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date June 26, 1961 Signed W.W. Holmes

(Engineer or Geologist) (Superintendent) Title Operator (President, Secretary or Agent)

Commenced drilling 6/14/61 Completed drilling 6/18/61 Drilling tools ~~Cable~~ Rotary

Total depth 5702 Plugged depth

Junk None

GEOLOGICAL MARKERS	DEPTH
Base Capay	4750

Commenced producing No Production (date) Flowing/gas lift/pumping (cross out unnecessary words)

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cementing if through perforations
7"	496'	0	20#	2nd.H	Seam	J-55	9 7/8	175 Sax	

PERFORATIONS

Size of Casing	From	To	Size of Perforations	Number of Rows	Distance Between Centers	Method of Perforations
	ft.	ft.				
	ft.	ft.				
	ft.	ft.				
	ft.	ft.				
	ft.	ft.				

DIVISION OF OIL AND GAS
RECEIVED
JUL 12 1961
WOODLAND, CALIFORNIA

077 00510

Electrical Log Depths IE and Sonic @ 5702 (Attach Copy of Log)

FORM 103

SUBMIT IN DUPLICATE

STATE OF CALIFORNIA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR W.W. Holmes, Operator FIELD King Island

Well No. "Klein" 1-28, Sec. 28, T. 3N., R. 5E., MD B. & M.

Date June 26, 1961 Signed W.W. Holmes

P.O. Box 301 Merced, Calif Title Operator

(Address) (Telephone Number) (President, Secretary or Agent)

RA. 2-8754

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data.

Date	
6/14/61	Spudded well at 1200 noon Drilled 97/8" hole 0'-501'. Ran 12 joints 7", J-55, 20#, 2nd. hand casing to 496'. Cemented using 175 sax type "A" cement all treated 3% Ca. Cl. Cement displaced with 115 cu. ft. H_2O. Had good returns to surface. Cement in place @ 950 P.M.
6/15/61	Landed 7" casing and installed B.O.P. Tested all preventers to 1500# ok. Drilled ahead in 61/4" hole 501-2434
6/16/61	" " " " " 2434-4023
6/17/61	" " " " " 4023-5011
6/18/61	" " " " " 5011-5702 Ran Schlumberger Induction Electrical log and sonic log. No commercial gas or oil shows.
6/19/61	With 31/2" drill pipe hung at 520' equalized 60 sax type "A" cement all treated 3% Ca. Cl. cmt in place at 630 a.m. Found top of set cement at 326'. Plug witnessed by Mr. Hunter of D.O.G. at 1130 a.m. Cut 7" surface pipe and 103/4" conductor pipe 4' below ground level and place 10' cement plug in stub of 7" casing. Welded steel cap on stub of 7".

WELL ABANDONED

FORM 109-D

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

Special Report on Operations Witnessed

No. T 661-211

Mr. W. W. Holmes
P. O. Box 301
Merced, California
Agent for W. W. HOLMES, OPERATOR

Woodland, Calif.
June 30, 1961

DEAR SIR:

Operations at well No. "Klein" 1-28, Sec. 28, T. 3 N., R. 5 E., M.D. B & M. ---- Field, in San Joaquin County, were witnessed on June 19, 1961. Mr. W. J. Hunter, representative of the supervisor was present from 12 M to 12:30 p.m. There were also present D. Dahlquist, Drilling Foreman and C. E. Todd, Driller

Present condition of well: 7" csm. 496'. T.D. 5702', plugged with cement 520'-326'

The operations were performed for the purpose of witnessing the location and hardness of a cement plug placed from 520' to 326' in the process of abandonment.

Mr. Dahlquist reported:

1. On June 14, 1961, 7", 20 lb. surface casing was cemented in a 9 7/8" hole at 496' with 175 sacks of cement treated with 3% calcium chloride. Cement returned to the surface.
2. A 6 1/4" hole was drilled to 5702'.
3. No commercial gas showings were encountered.
4. On June 19, 1961, 60 sacks of cement treated with 3% calcium chloride was pumped into the hole through drill pipe hanging at 520'.

THE ENGINEER NOTED that the cement plug at 326' supported all of the weight of the drill pipe.

THE LOCATION AND HARDNESS OF THE CEMENT PLUG AT 326' ARE APPROVED.

WJH:njj

E. H. MUSSER
State Oil and Gas Supervisor
By J. E. Kasline Deputy

13103 2-60 15M ⓓ SPO

FORM 111

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS

No. P 661-270

Mr. W. W. Holmes
P. O. Box 301
Merced, California
Agent for W. W. HOLMES, OPERATOR

Woodland, Calif.
June 30, 1961

DEAR SIR:

Your proposal to abandon Well No. "Klein" 1-28,

Section 28, T. 3 N., R. 5 E., M.D.B. & M., --- Field, San Joaquin County,

dated June 24, 1961 received June 29, 1961, has been examined in conjunction with records filed in this office.

Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:
"THE PRESENT CONDITION OF THE WELL IS:
1. Total Depth: 5702
2. Complete casing record, including plugs:
7" cemented 496
3. Last Produced No Production
ADDITIONAL DATA FOR DRY HOLE
4. Oil or Gas showings and results of tests:
None
5. Stratigraphic markers and depths:
Base Capay 4750±
6. Geologic age at bottom: Paleocene
7. Base of fresh water sands: No fresh water logged"

PROPOSAL:
"THE PROPOSED WORK IS
1. Hang open end drill pipe at 520 and equalize sufficient cement to fill to 470.
2. Cut 7" at 10 3/4" at 4' below ground level and place 10' cement plug in stub of 7" casing.
This notice confirms telephone conversation between W. W. Holmes and a representative of the D.O.G. on the night of June 18, 1961."

DECISION:
THE PROPOSAL COVERING WORK ALREADY COMPLETED UNDER PRIOR AGREEMENT IS APPROVED.

Bond dated 5-1-61

FEK:njj

E. H. MUSSER, State Oil and Gas Supervisor

By J. E. Kasline, Deputy

37870 3-61 15M SPO

FORM 108. 25462 10-55 25,550 ⓒ SPO

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin; one copy only

Merced Calif. June 24 19 61

DIVISION OF OIL AND GAS

In compliance with Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon

Well No. "Ilene" 1-28, Sec. 28, T. 3N,

R. 5E, MD B. & M., King Island Field, San Joaquin County,

commencing work on June 24, 19 61.

THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 5732

2. Complete casing record, including plugs:

7" cemented 450

3. Last Produced No Production
(Date) (Oil, B/D) (Water, B/D)

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:

None

5. Stratigraphic markers and depths:

Base Capay 4750±

6. Geologic age at bottom: Paleocene

7. Base of fresh water sands: No fresh water logged

THE PROPOSED WORK IS

1. Hang open end drill pipe at 520 and equalize sufficient cement to fill to 470.

2. Jet 7" at 10 3/4" at 4' below ground level and place 10' cement plug in stub of 7" casing.

This notice confirms telephone conversation between W. W. Holmes and a representative of the D.O.G. on the night of June 13, 1961.

DIVISION OF OIL AND GAS
RECEIVED
JUN 26 1961
WOODLAND, CALIFORNIA

7/11/61

P. O. Box 301, Merced, Calif. W. W. Holmes, Operator
(Address) (Name of Operator)

Randolph 2-6754 By W W Holmes
(Telephone No.)

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

FORM 111

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS

No. P 661-179

Mr. W. W. Holmes
P. O. Box 301
Merced, California
Agent for W. W. HOLMES, OPERATOR

Woodland, Calif.
May 5, 1961

DEAR SIR:

Your proposal to drill Well No. "Klein" 1-28,

Section 28, T. 3 N., R. 5 E., M.D.B. & M., — Field, San Joaquin County,

dated May 1, 1961, received May 5, 1961, has been examined in conjunction with records filed in this office.

Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:

"Legal description of mineral right lease, consisting of 572.06 acres, is as follows:
Plat attached
Do mineral and surface leases coincide? Yes X
Location of Well: 2200 feet West along section line and 2100 feet South at right angles to said line from the North East corner of projected Section 28, T3N; R5E., M.D.B. & M., San Joaquin County, California.
Elevation of ground above sea level 4 feet Topo datum.
All depth measurements taken from top of KB which is 11.5 feet above ground."

PROPOSAL:

"PROPOSED CASING PROGRAM

Size of casing Inches A.P.I.	Weight	Grade and Type	Top	Bottom	Cementing Depths
7"	20#	J-55 T&C	0	500	Cmt. Solid
4½"	9.5#	J-55 T&C	0	Est. Depth 5200	Cmt. from bottom

Intended zone or zones of completion: G & P Sand (Depth, top and bottom)
Estimated total depth 5500
It is understood that if changes in this plan become necessary we are to notify you immediately."

DECISION:

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Mud fluid of sufficient weight and proper consistency to prevent blow-outs shall be used in drilling, and the column of mud fluid shall be maintained to the surface at all times, particularly while pulling the drill pipe.
2. Adequate blow-out prevention equipment shall be provided and maintained ready for operation at all times.
3. In the event the 4½" casing is cemented below the surface casing, fresh waters shall be protected by cement behind the casing. Sufficient cement shall be used to fill to at least 100' above the base of fresh waters.
4. This Division shall be notified:
   a. To inspect blow-out prevention equipment prior to drilling below a depth of 1000'.
   b. To witness a test of the 4½" water shut-off immediately above the objective zone.

Bond dated 5-1-61

E. H. MUSSER, State Oil and Gas Supervisor

By F. E. Kasline, Deputy

OWB:njj

115

96787 4-59 30M SPO

ORM 105

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and surety bond must be filed before drilling begins

077-00510

7

Merced Calif. May 1, 1961

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division III, Article 4, Public Resources Code, notice is hereby given that it is our intention to commence the work of drilling well No. Klein 1-28, Sec. 28, T. 3N., R. 5E., M.D. B. & M., Field, San Joaquin County.

Legal description of mineral right lease, consisting of 572.06 acres, is as follows: Plat (Attach map or plat to scale) attached

Do mineral and surface leases coincide? Yes X No ____ If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of Well: 2200 feet West (Direction) along section line and 2100 feet South (Direction) at right angles to said line from the North East corner of ~~property~~ projected Section 28, T3N; R5E., M.D.B.&M., San Joaquin County, California.

Elevation of ground above sea level 4 feet Topo datum.

All depth measurements taken from top of KB (Derrick Floor, Rotary Table or Kelly Bushing) which is 11.5 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES A.P.I.	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS
7"	20#	J-55 T&C	0	500	Cmt. solid
4½"	9.5#	J-55 T&C	0	Est.Depth	Cmt. from bottom

Intended zone or zones of completion: G & P Sand (Name) 5200 (Depth, top and bottom)

Estimated total depth 5500

MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
	5/4/61	✓	5-1-61	✓	✓

077 00510

DIVISION OF OIL AND GAS
RECEIVED
MAY 5 1961
WOODLAND, CALIFORNIA

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address P.O.Box 301 Merced, California

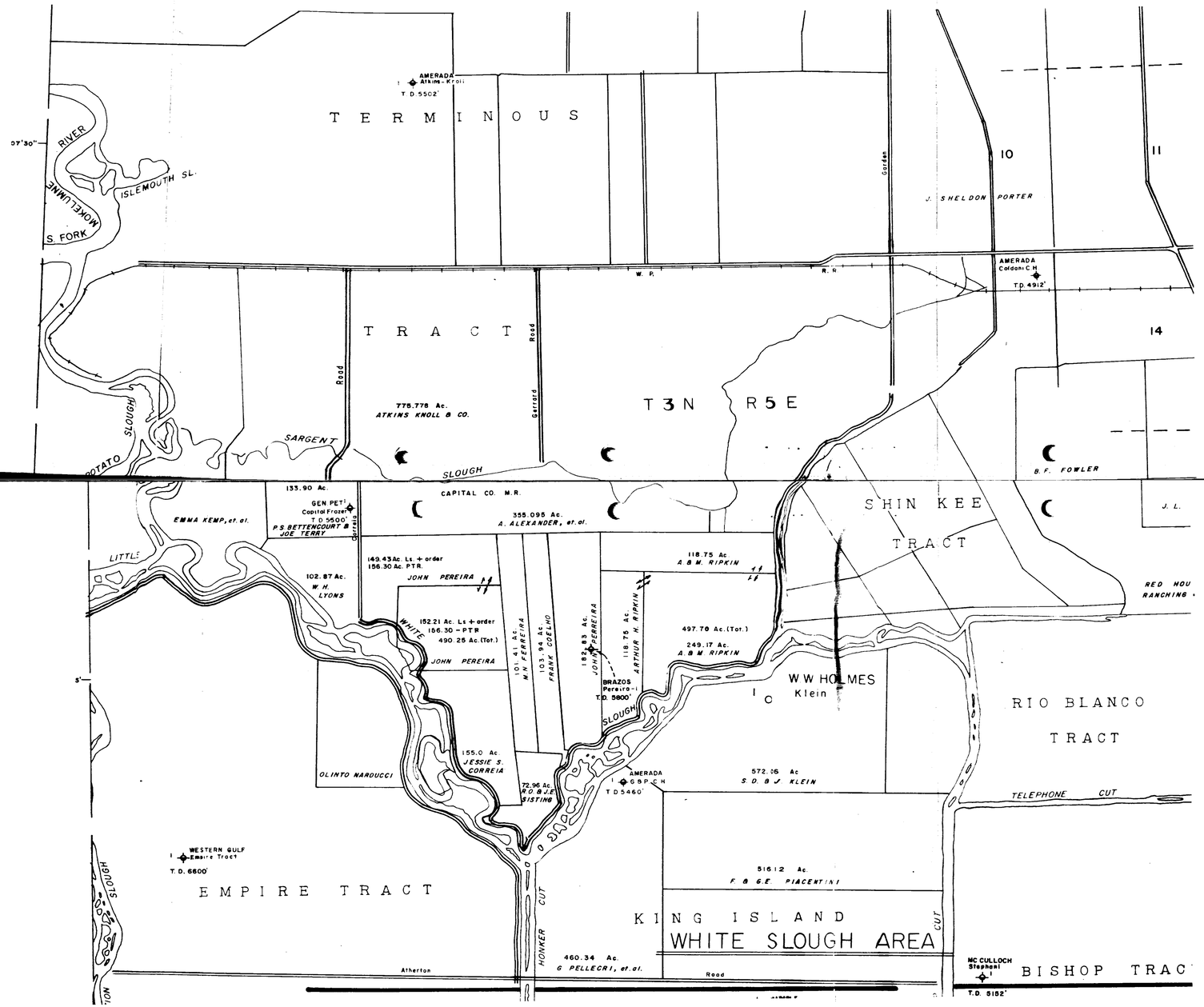
W. W. HOLMES, Operator (Name of Operator)

Telephone Number RA 2-8754

By W W Holmes

Type of Organization (Corporation, Partnership, Individual, etc.)

96788 4-59 20M △ SPO



DIVISION OF OIL AND GAS
RECEIVED
MAY 4 1961
WOODLAND, CALIFORNIA

077 00510

OTHER

HALLIBURTON

EXCELL 2000

THERMAL MULTIGATE
DECAY
LITHOLOGY

COMPANY SIERRA RESOURCE INC.
WELL MORESCO ET AL UNIT A #1
FIELD KING ISLAND
COUNTY SAN JOAQUIN STATE CALIF.

COMPANY SIERRA RESOURCE INC.

WELL MORESCO ET AL UNIT A #1

FIELD KING ISLAND

COUNTY SAN JOAQUIN STATE CALIF.

API No. 04-077-20469
Location 2800 FEET NORTH AND 350 FEET WEST FROM THE SOUTHEAST CORNER OF:

Sect 28 Twp 3N Rge 5E

Other Services
NONE

Permanent Datum G.L. Elev. 7.80
Log measured from K.B. 10.2 ft. above perm. datum
Drilling measured from K.B.

Elev.: K.B. 18.0
D.F. —
G.L. 7.80

Date	03/08/97				
Run No.	ONE				
Depth - Driller	4950.00				
Depth - Logger	4879.00				
Bottom Logged Interval	4869.00				
Top Logged Interval	4540.00				
Type fluid in hole	WATER				
Salinity, PPM NaCl	2.0				
Density	8.3				
Level	2000.00				
Max. rec. temp., deg F.	N/R				
Operating rig time	3.5 HOURS				
Hoist Unit / Location	51535 / WOLD.	/	/	/	
Inst. Unit / Location	51535 / WOLD.	/	/	/	
Recorded by	JOHN GUNBY				
Witnessed by	MR.D. EBERTS				

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 05 1997
Sacramento, California

BOREHOLE RECORD			CASING & TUBING RECORD			
Bit	From	To	Size	Wgt.	From	To
			9.625	24.0	SURF.	723.00
			5.50	15.0	SURF.	5000.00
			2.786	6.5	SURF.	4639.00

Service Ticket No.: 210908 API Serial No.: 04-077-20469 PGM Version: XL v2.40

EQUIPMENT DATA

GAMMA				NEUTRON GENERATOR		
Run No.	ONE			Run No.	ONE	
Serial No.	17			Gen Hsg s/n	15	
Model No.	TMDL			Inst Hsg s/n	15	
Diameter	1.686			Case Diameter	1.686	
Detector Model No.	17			Detector 1 s/n	15	
Type	NAL			Detector 2 s/n	15	
Length	13.4			Generator s/n	86489	
Distance to Source	4.0			Fluid Excluder	NAL	

LOGGING DATA

GENERAL			GAMMA				NEUTRON GENERATOR					
Run No.	Depth From	Depth To	Speed Ft / Min	Filter Type	Scale L	Scale R	Input Filter Type	Output Filter	Borehole Option	Scale L	Scale R

Date of Last Survey

Remarks:

THANK YOU FOR USING HALLIBURTON.

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

HALLIBURTON

PRIMARY PRESENTATION

HALLIBURTON

Version No: 2.40 | hc:2.0
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Control File: plot_01_1.spc
Raster File: 0906_1714_r0601.plot_01_1

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Bottom Depth: 4875.75
Database Time: 05-06-07 17:29:40

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-25 API 125	3000 50	60 CU 0	
NEAR BORE SI		INTRINSIC SI	
240 40		60 CU 0	
RNFC		RTMD	NEAR COUNTS
6 1		9 4	60000 COUNTS 0
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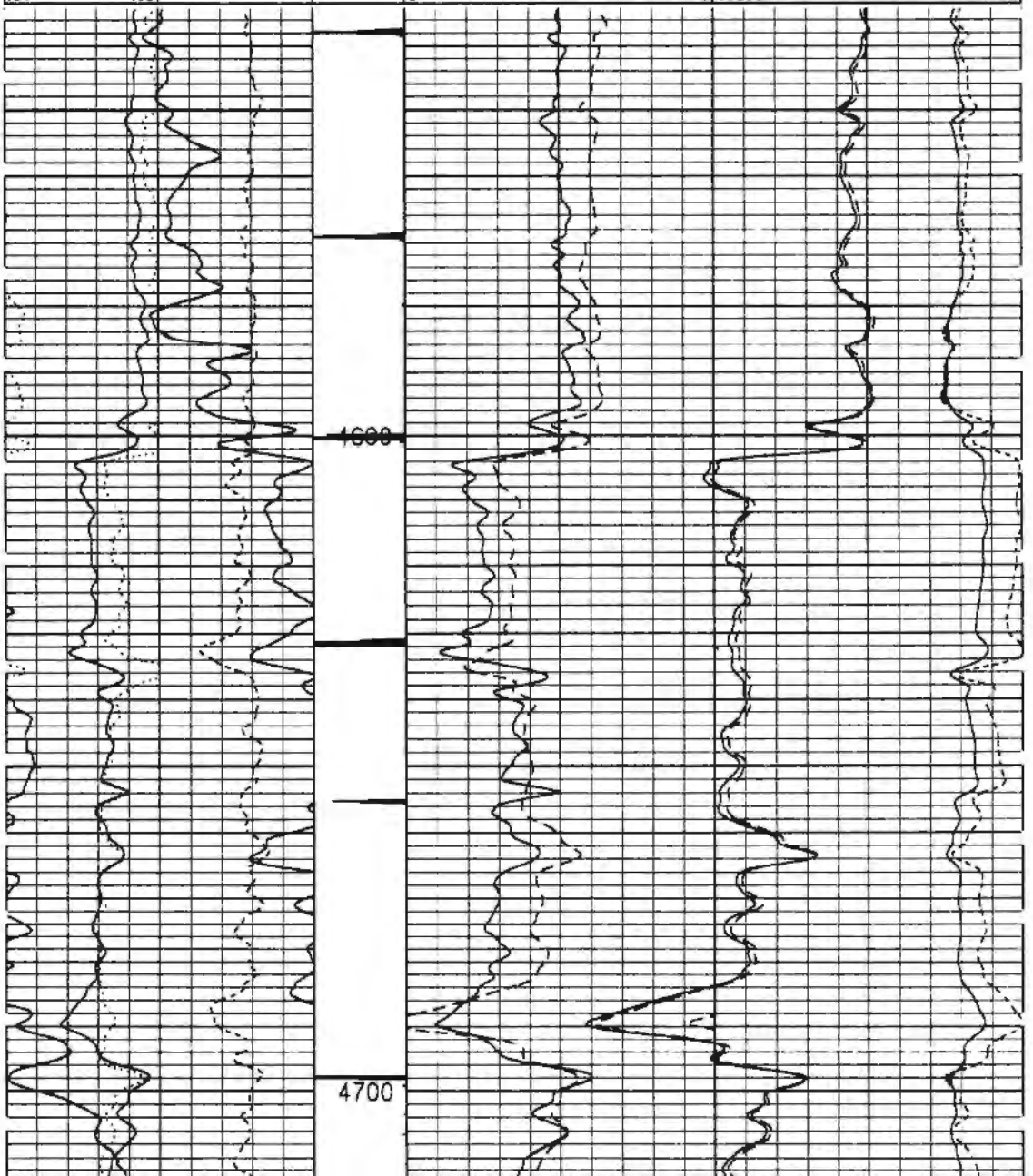
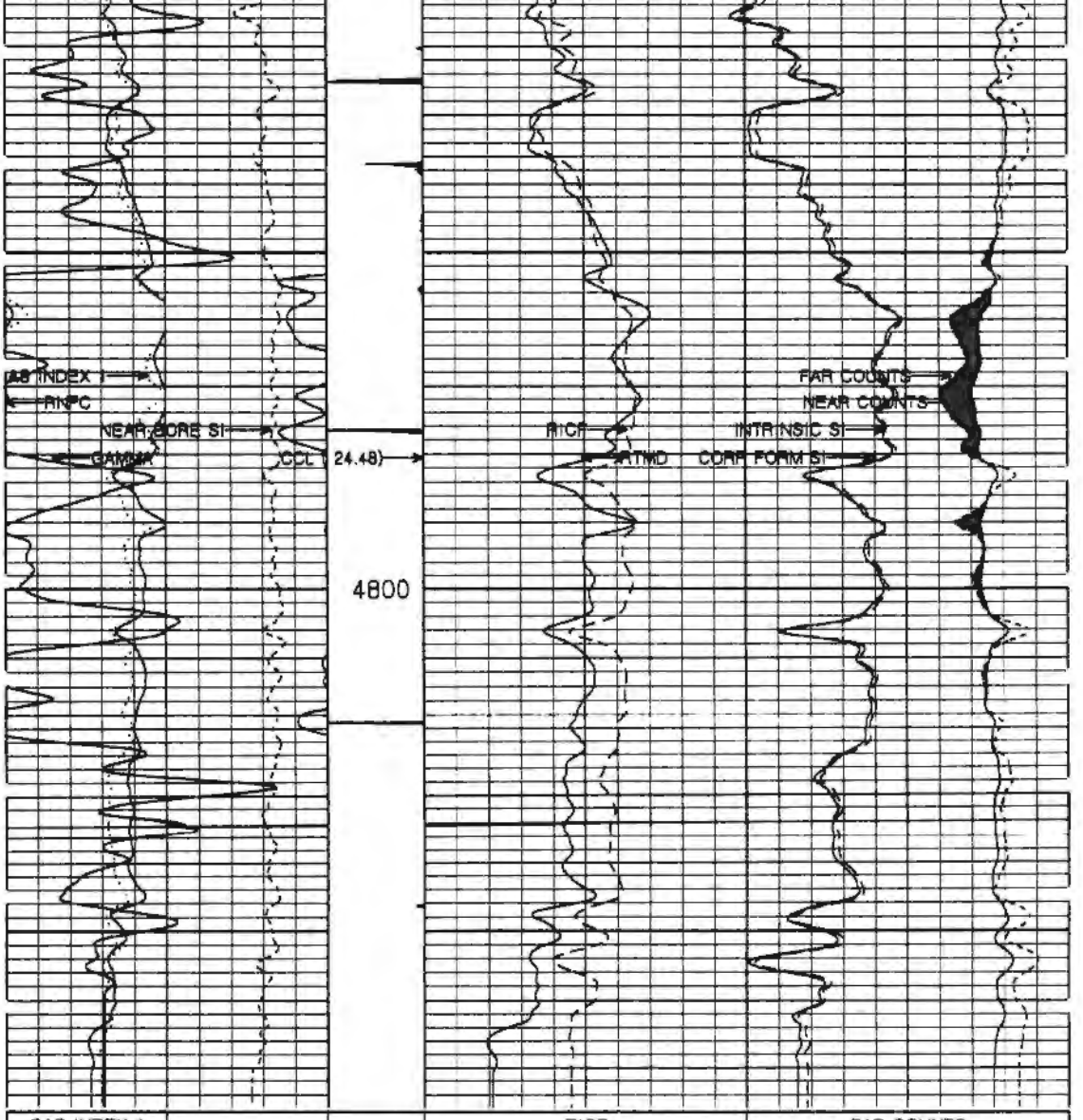
.01 .03		5 0	10600 1400





GAS INDEX 1			RICF		FAR COUNTS	
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RNEC			RTMD		NEAR COUNTS	
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NEAR BORE SI			INTRINSIC SI			
240	40		60	CU		0
GAMMA		CCL (IN.HG)	CORR FORM SI			
-25	API 125	3000 50	60	CU		0

HALLIBURTON

Version No: 2.40 | hc:2.0
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Raster File: 0308_1714_r0501.plot_01_1

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Bottom Depth: 4875.75
Database Time: 03-08-97 17:29:40

REPEAT SECTION PRIMARY PRESENTATION

HALLIBURTON

Version No: 2.40 | hc:2.0
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Control File: plot_01_1.spc
Raster File: 0308_1714_r0501.plot_01_1

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Bottom Depth: 4866.00
Database Time: 03-08-97 17:27:27

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NEAR BORE SI			INTRINSIC SI			
240	40		60	CU		0
RNEC			RTMD		NEAR COUNTS	
6	1		9	4	60000 COUNTS	0
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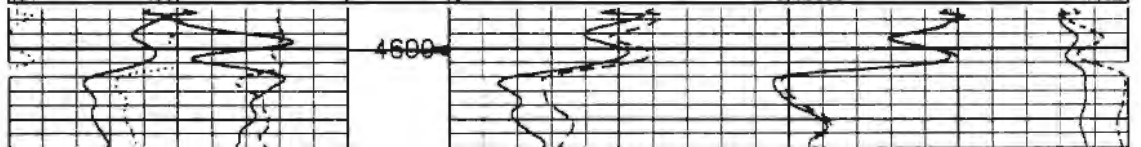
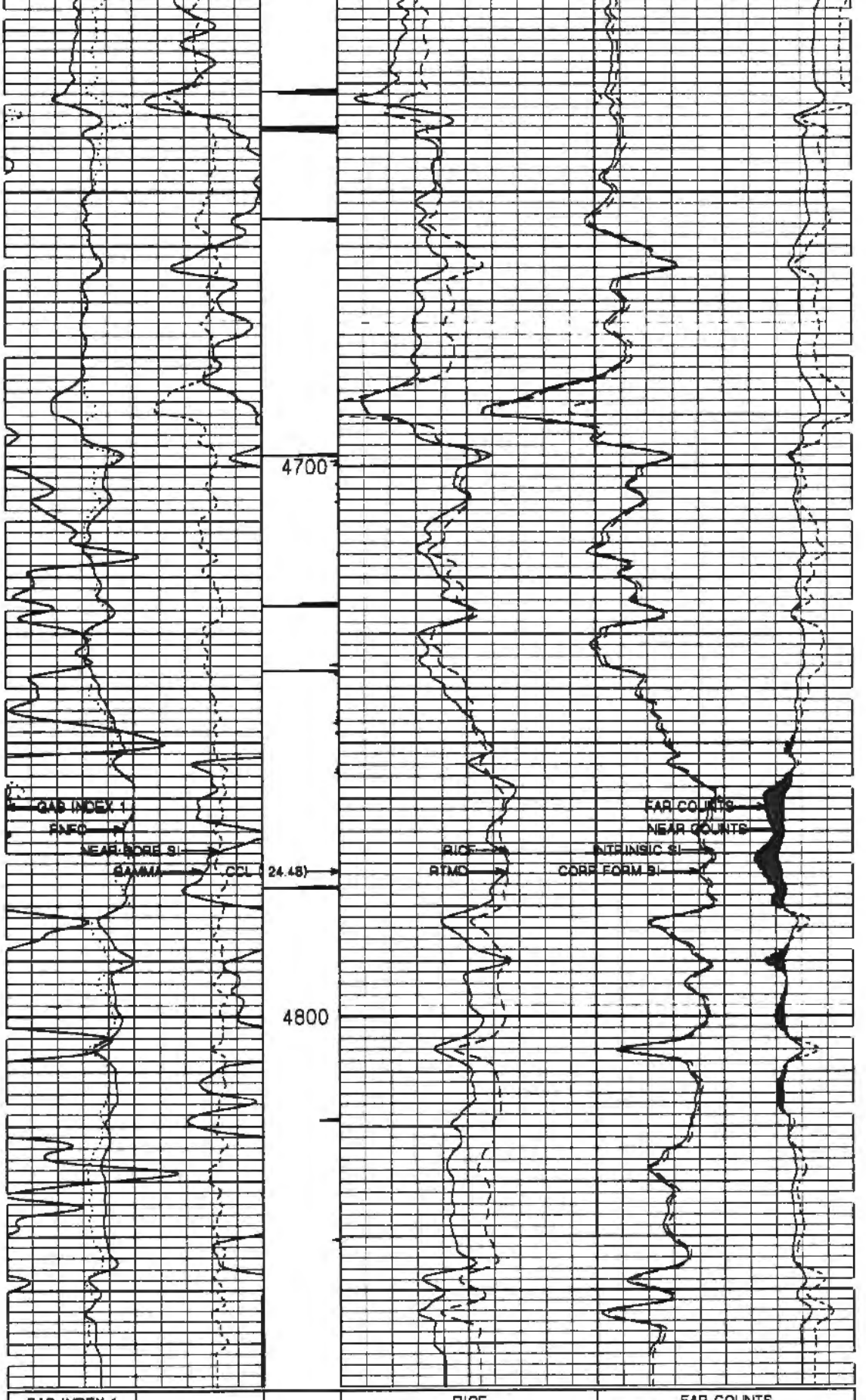
.01	.03		5	0	10600	1400





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RNEC 6 1			RTMD 9 4		NEAR COUNTS 60000 COUNTS 0
NEAR BORE SI 240 40					INTRINSIC SI 60 CU 0
GAMMA -25 API 126	CCL (24.48) 3000 60				CORR FORM SI 60 CU 0

HALLIBURTON

Version No: 2.40 ! hc:2.0

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Bottom Depth: 4866.00

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HALLIBURTON

Version No: 2.40 I ho:2.0 Top Depth: 4584.00

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Control File: plot_01_1.epc

Raster File: 0808_1714_r0801.plot_01_1 Database Time: 08-08-97 17:16:47

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GAMMA
0 API 150
FAR FIT ERR
0 20

SGFN
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SGFF
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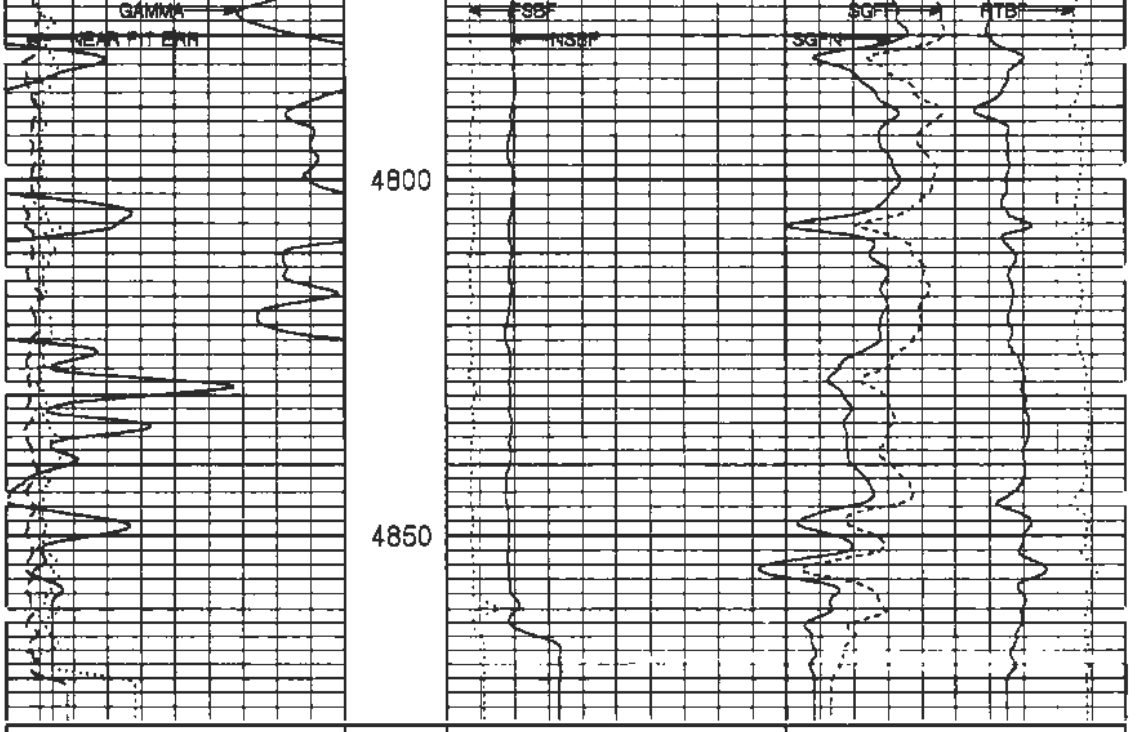
FSBF RTBF
0 1000 5 0

4550
4600
4650
4700
4750

← FAR FIT ERR

ABTN →



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		SGFN 60 0

HALLIBURTON

Version No: 2.40 | hc2.0
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Raster File: 0808_1714_r0501.plot_01_1
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Bottom Depth: 4875.75
Database Time: 03-08-07 17:16:47

REPEAT SECTION QUALITY PRESENTATION

HALLIBURTON

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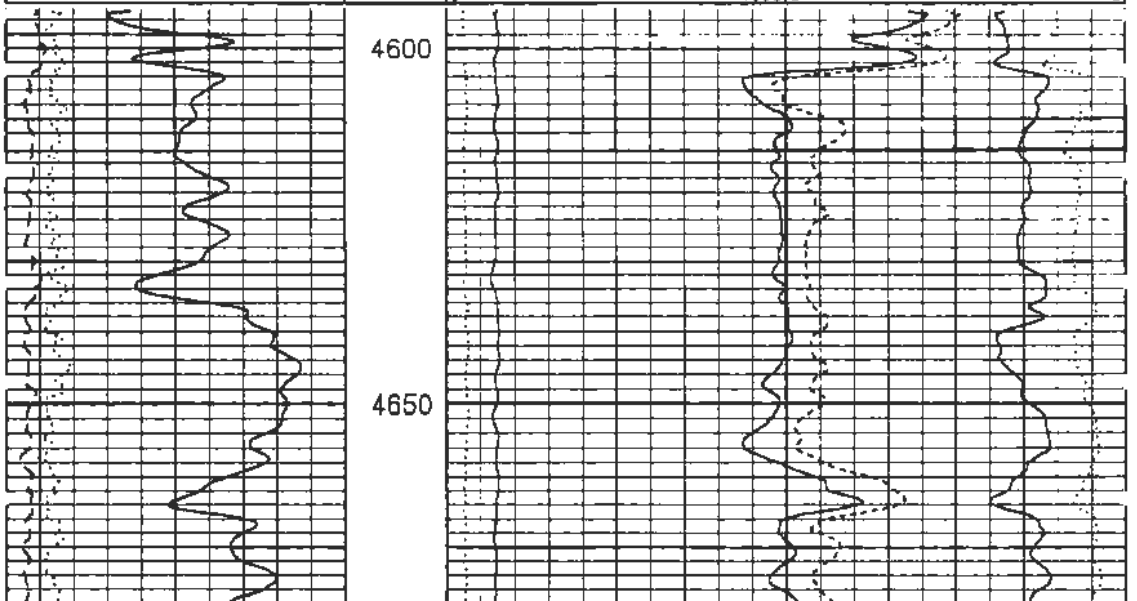

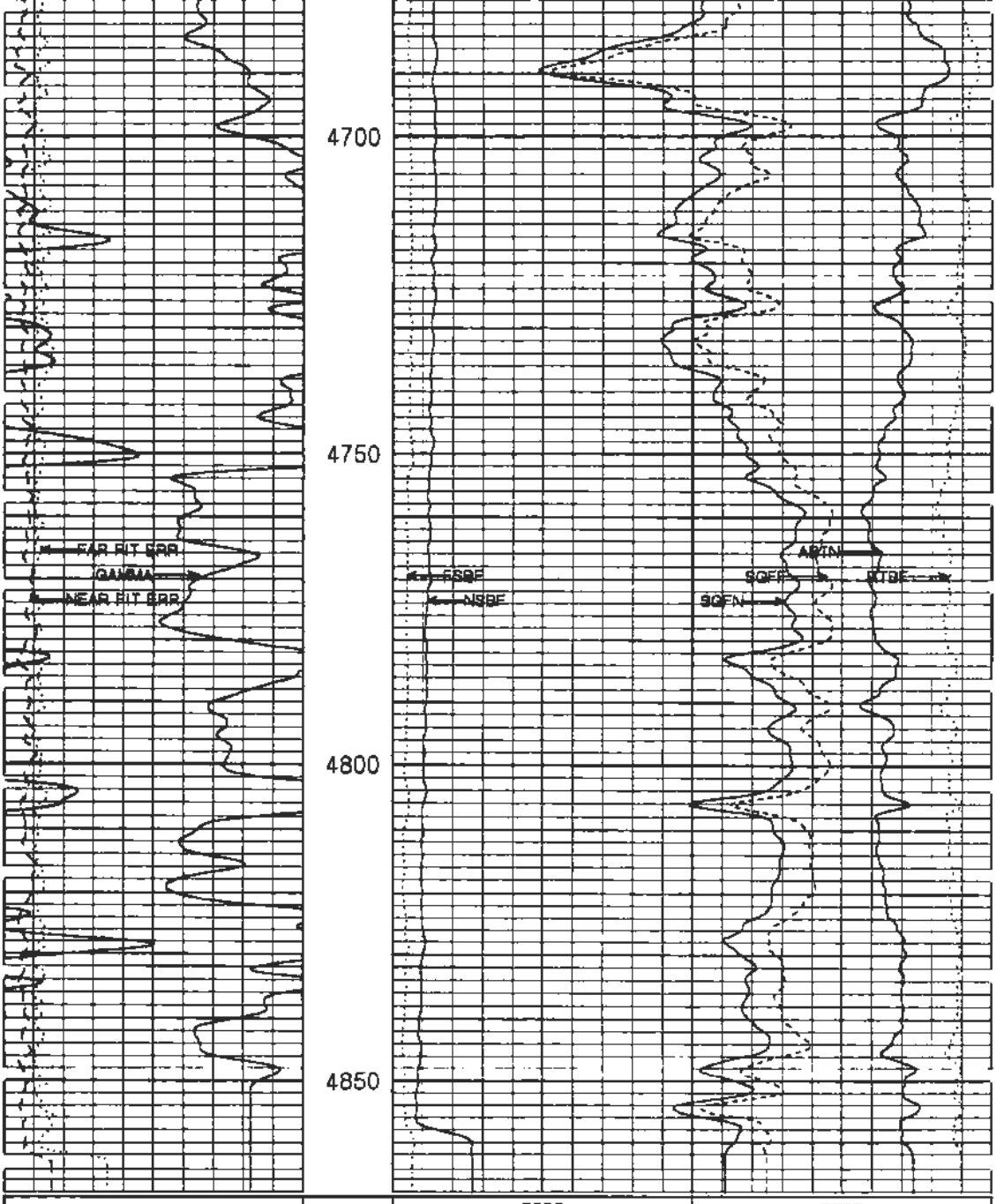

HALLIBURTON

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Raster File: 0908_1714_r0601.plot_01_1

Top Depth: ———
Bottom Depth: 4866.00
Database Time: 03-08-97 17:16:38

Current EXCELL-2000 Parameter Values
Depth: 0.000
Date: 08-Mar-1997 17:14

Mnemonic	Tool	Parameter Description	Value	Units
PERF	TTTCHD	PERFORATED INTERVAL	NO	
CCLSEL	CCL_TT	CCL PROCESSING SELECTION	RAW	
CCLOFS	CCL_TT	CCL PERFORATION OFFSET	0	
GR_OK	GR_TT	DO GAMMA CALCULATIONS	YES	
CASED	GR_TT	IS THIS A CASED HOLE	YES	
CASEOD	SHARED	CASING DIAMETER (OD)	5.5	Inches
CASEWT	GR_TT	CASING WEIGHT	15.	Pounds/Ft.
CASCEM	GR_TT	CASING IN CEMENT?	YES	
CEMWT	GR_TT	CEMENT WEIGHT	15.	Pounds/Gal.
MUDWT	GR_TT	BOREHOLE FLUID WEIGHT	8.3	Pounds/Gal.
GRSO	GR_TT	GAMMA RAY STANDOFF	0.	Inches

BS	SHARED	BIT SIZE	7.875	Inches
TMDLOK	TMDL	DO TMDL CALCULATIONS?	YES	
SENS	TMDL	TMDL SENSITIVITY	1.612954	
CSF	TMDL	AIR FILLED BOREHOLE ?	NO	
BORSAL	TMDL	BORE HOLE SALINITY KPPM	0.2	KPPM
LTH	TMDL	DESIRED LITHOLOGY	SAND	
ICCM	TMDL	CEMENT SALINITY > 40 KPPM?	NO	
REST	TMDL	RESOLVING TIME (DEAD TIME)	1.231889	
GENSD	TMDL	GENERATOR SAFE DEPTH	100.	FT

EXCELL-2000 Calibration Report
Date: 08-Mar-1997 17:13

NATURAL GAMMA - TTTC SHOP CALIBRATION SUMMARY

PERFORMED: 28-Feb-1997 15:59 LAST SHOP CALIBRATION: 28-Feb-1997 15:56
SERIAL NUMBER: B017 MODEL: GR_TT
TRUCK UNIT NUMBER: PROGRAM VERSION: 2.40
PERFORMED BY: G. ROUSSEAU

	MEASURED	CALIBRATED	UNITS
BACKGROUND	31	31	GAPI
BACKGROUND+CALIBRATOR	282	282	GAPI
CALIBRATOR	252	251	GAPI
GAPI CONVERSION FACTOR	0.814		GAPI/CPS

THERMAL MULTIGATE DECAY LITH SHOP CALIBRATION SUMMARY

PERFORMED: 28-Feb-1997 15:22 LAST SHOP CALIBRATION: 03-Nov-1996 13:59
SERIAL NUMBER: A015 MODEL: TMDL
TRUCK UNIT NUMBER: PROGRAM VERSION: 2.40
PERFORMED BY: G. ROUSSEAU

RESULT	LOGGED	EXPECTED VALUE	DIFF.	TOL.	UNITS
SENSITIVITY	1.61	1.65	0.04	+/-0.15	
NEAR SPACED CNT	12829.9	10000-15000			CPS
FAR SPACED CNT	4018.3	3000-5000			CPS
SIGMA FORM NEAR	24.19	24.00	-0.19	+/-0.50	C.U.
SIGMA BORE NEAR	85.73	82.00	-3.73	+/-5.00	C.U.
SIGMA FORM FAR	22.68	23.00	0.32	+/-1.00	C.U.
RATIO NEAR/FAR	3.19	3.10	-0.09	+/-0.45	
CORR FORM SIGMA	21.874	21.70	-0.17	+/-0.50	C.U.
RATIO BORE/FORM	0.23	0.25	0.02	+/-0.05	C.U.
NEAR ERROR	0.87	<5.0			
FAR ERROR	0.65	<5.0			
NEAR BACKGROUND	239.01	<1000			
FAR BACKGROUND	59.38	<1000			
RESOLVING TIME	1.232	0.0 - 2.0			

2DIL1

Schlumberger

2" DUAL INDUCTION-SFL

CSU

COMPANY: SIERRA RESOURCES, INC.

WELL: "MORESCO ET AL UNIT A" #1

FIELD: KING ISLAND
COUNTY: SAN JOAQUIN
STATE: CALIFORNIA
NATION: U.S.A.
LOCATION: 2900'N AND 350'W
FROM SE CORNER
SEC: 28 TWP: 3N RGE: 5E

OIL AND GAS
RECEIVED
1985
CALIFORNIA

077 20469

PERMANENT DATUM: GL
ELEV. OF PERM. DATUM: -7.8 F
LOG MEASURED FROM: KB
10.2 F ABOVE PERM. DATUM
DRLG. MEASURED FROM: KB

ELEVATIONS- 32'
KB: ~~1070~~ F
DF: 17.0 F
GL: -7.8 F

DATE: 12 SEP 85
RUN NO: 1

DEPTH-DRILLER: 6500.0 F
DEPTH-LOGGER: 6480.0 F
BTM. LOG INTERVAL: 6474.0 F
TOP LOG INTERVAL: 722.0 F

CASING-DRILLER: 723 F
CASING-LOGGER: 722 F
CASING: 8 5/8"

BIT SIZE: 7 7/8"
DEPTH: 6500 F

OTHER SERVICES-
BHC
LDT-CNL-GR
HDT

PROGRAM
TAPE NO:
26.2
SERVICE
ORDER NO:
432459

TYPE FLUID IN HOLE: CYPAN-OMNIPOL
DENSITY: 10.2 LB/G
VISCOSITY: 40.0 S
PH: 8.0
FLUID LOSS: 7.2 C3
SOURCE OF SAMPLE: FLOWLINE
RM: 4.610 OHMM AT 70.0 DEGF
RMF: 4.580 OHMM AT 63.0 DEGF
RMC: 3.750 OHMM AT 63.0 DEGF
SOURCE RMF/RMC: MEASURED/MEASURED

RM AT BHT:	2.382 OHMM AT 142. DEGF
RMF AT BHT:	2.151 OHMM AT 142. DEGF
RMC AT BHT:	1.761 OHMM AT 142. DEGF
TIME CIRC. STOPPED:	09:00 9-12
TIME LOGGER ON BTM.:	13:36 9-12
MAX. REC. TEMP:	142.0 DEGF
LOGGING UNIT NO:	8128
LOGGING UNIT LOC:	SACRAMENTO
RECORDED BY:	PILCH
WITNESSED BY:	WIESE

REMARKS:

INDUCTION AND SONIC RAN IN COMBINATION.
400PPM CHLORIDES.
CME-Z'S AND STANDOFF USED FOR CENTRALIZATION.
RWA CURVE ON TIMES TEN BACK-UP.

EQUIPMENT NUMBERS-

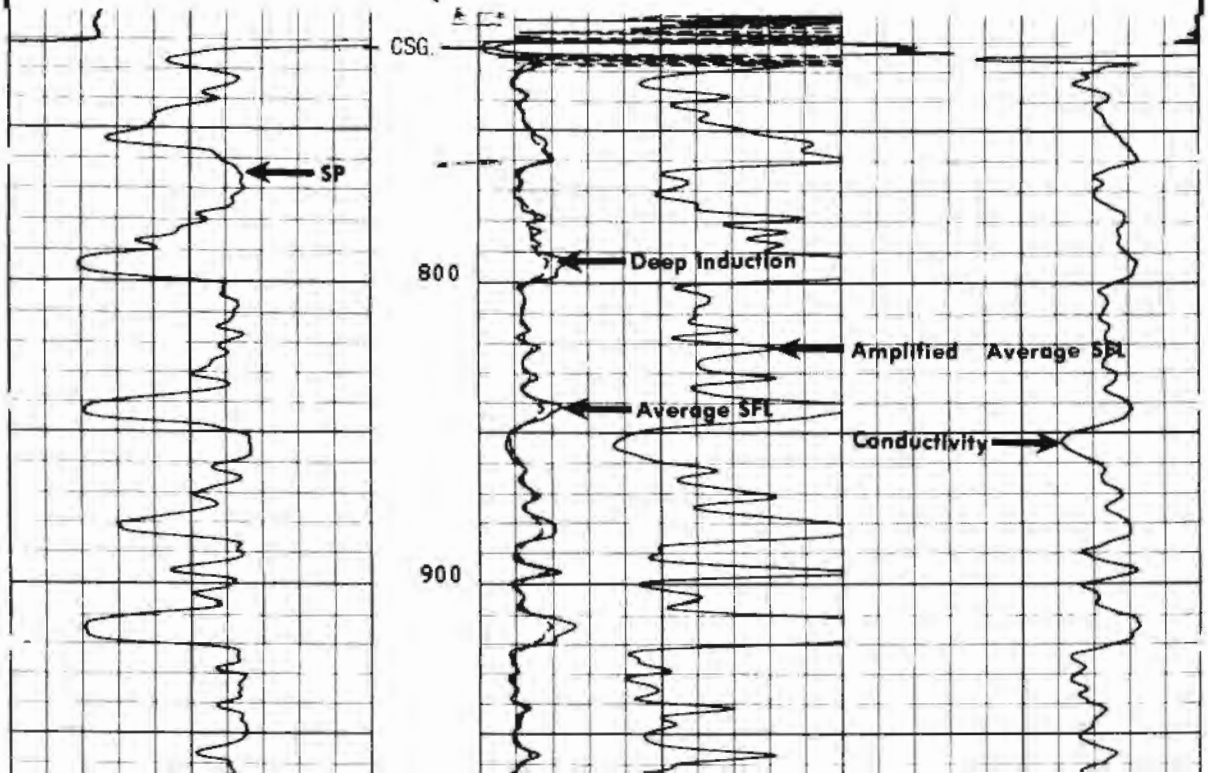
DIS-EC 211	DIC-DA 217	SLS-RC 320	SLC-FA 472
MCD-DA 280	IEM-BC 1070	SLM-CA 138	

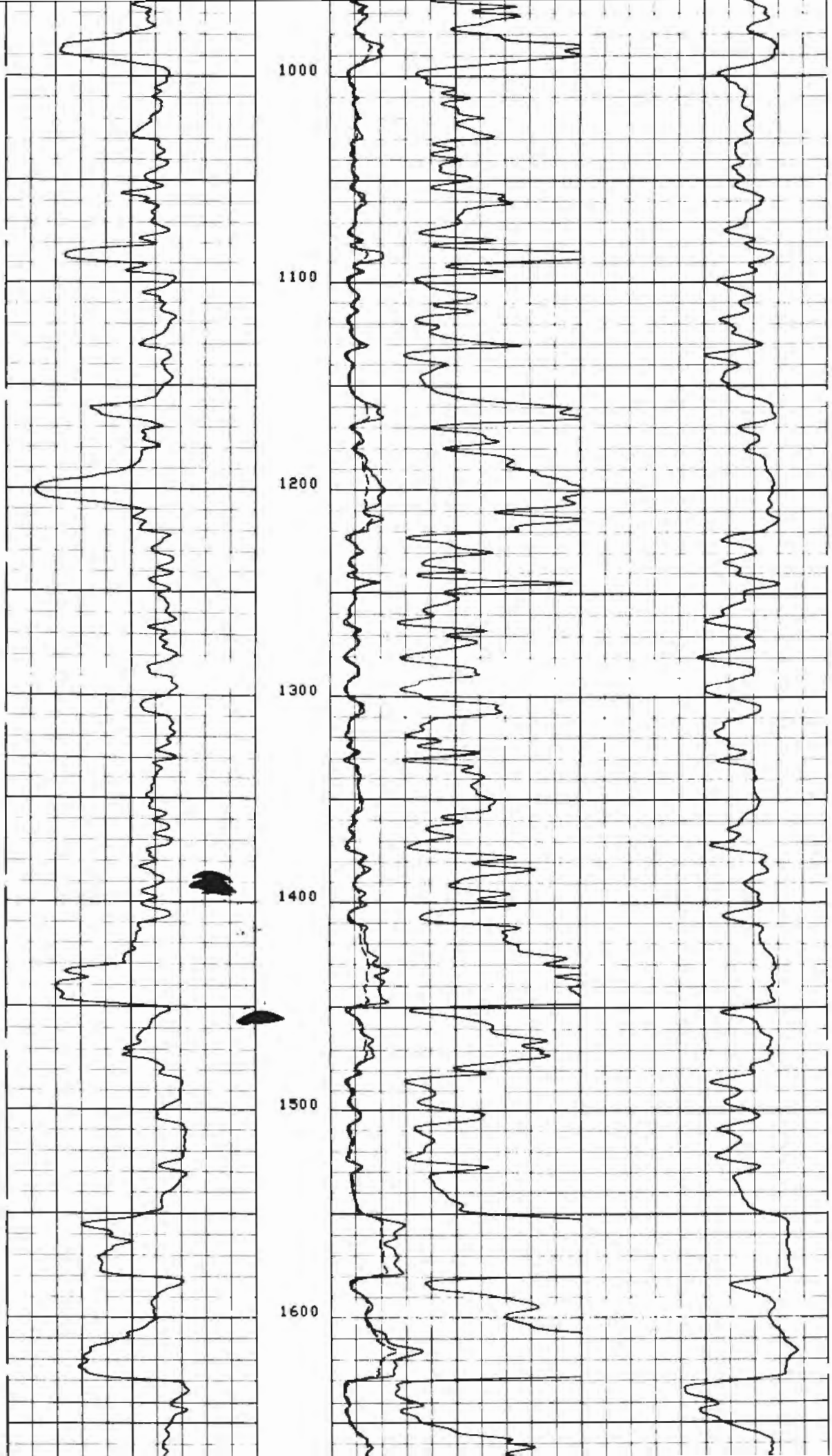
ALL INTERPRETATIONS ARE OPINIONS BASED ON INFERENCES FROM ELECTRICAL OR OTHER MEASUREMENTS AND WE CANNOT, AND DO NOT GUARANTEE THE ACCURACY OR CORRECTNESS OF ANY INTERPRETATIONS, AND WE SHALL NOT, EXCEPT IN THE CASE OF GROSS OR WILLFUL NEGLIGENCE ON OUR PART, BE LIABLE OR RESPONSIBLE FOR ANY LOSS, COSTS, 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 AS SET OUT IN OUR CURRENT PRICE SCHEDULE.

FILE 102 12-SEP-85 15:20
DATA ACQUIRED 12-SEP-85 15:01

SP (MV)		ILD (OHMM)	CILD(MMHO)
		0.0 30.000	
		SFLA(OHMM) 0.0 6.0000	
-100.0 0.0		SFLA(OHMM) 0.0 30.000	1000.0 0.0

FILE 101 12-SEP-85 15:19
DATA ACQUIRED 12-SEP-85 15:01

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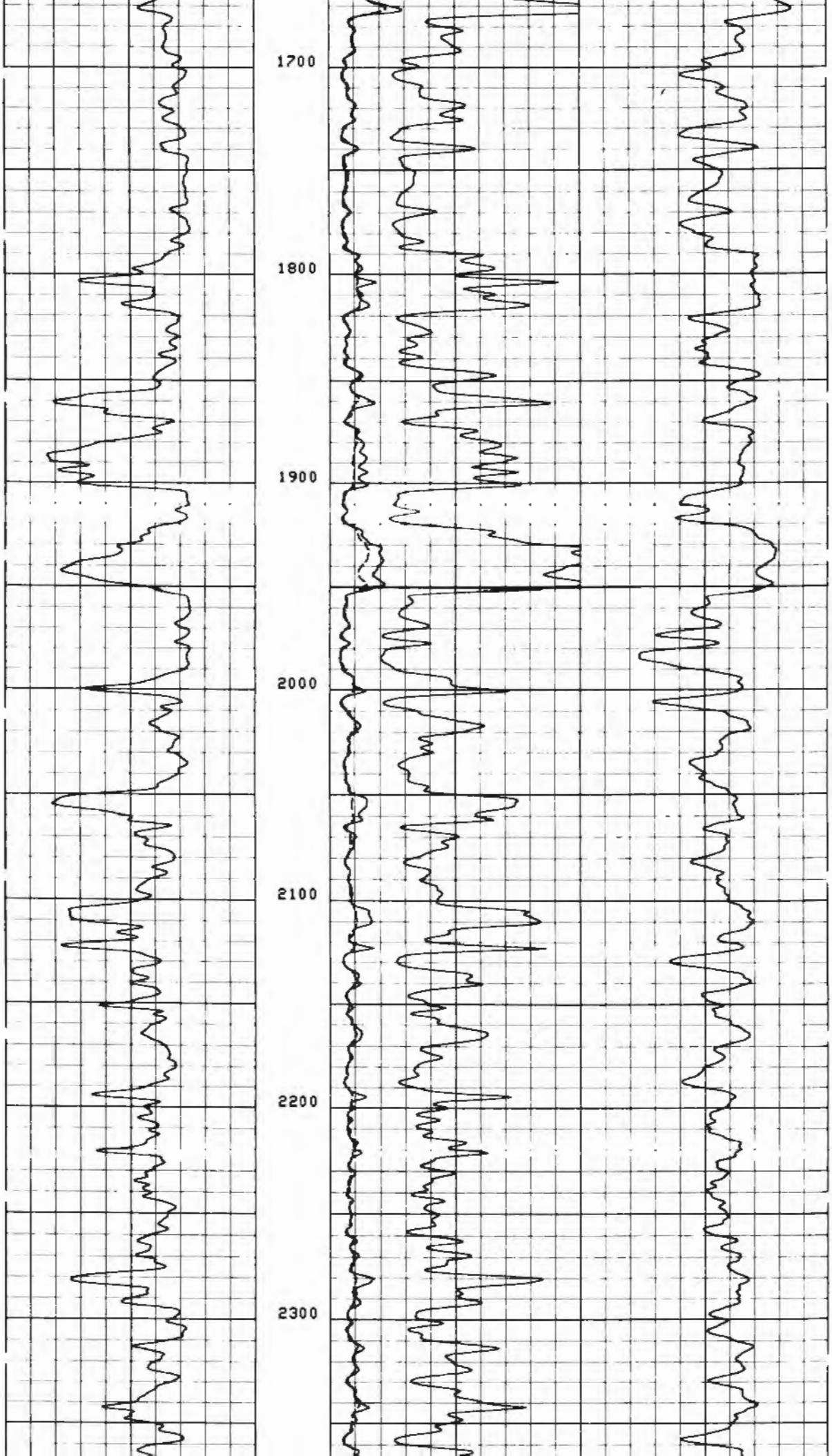
1200
1300
1400
1500
1600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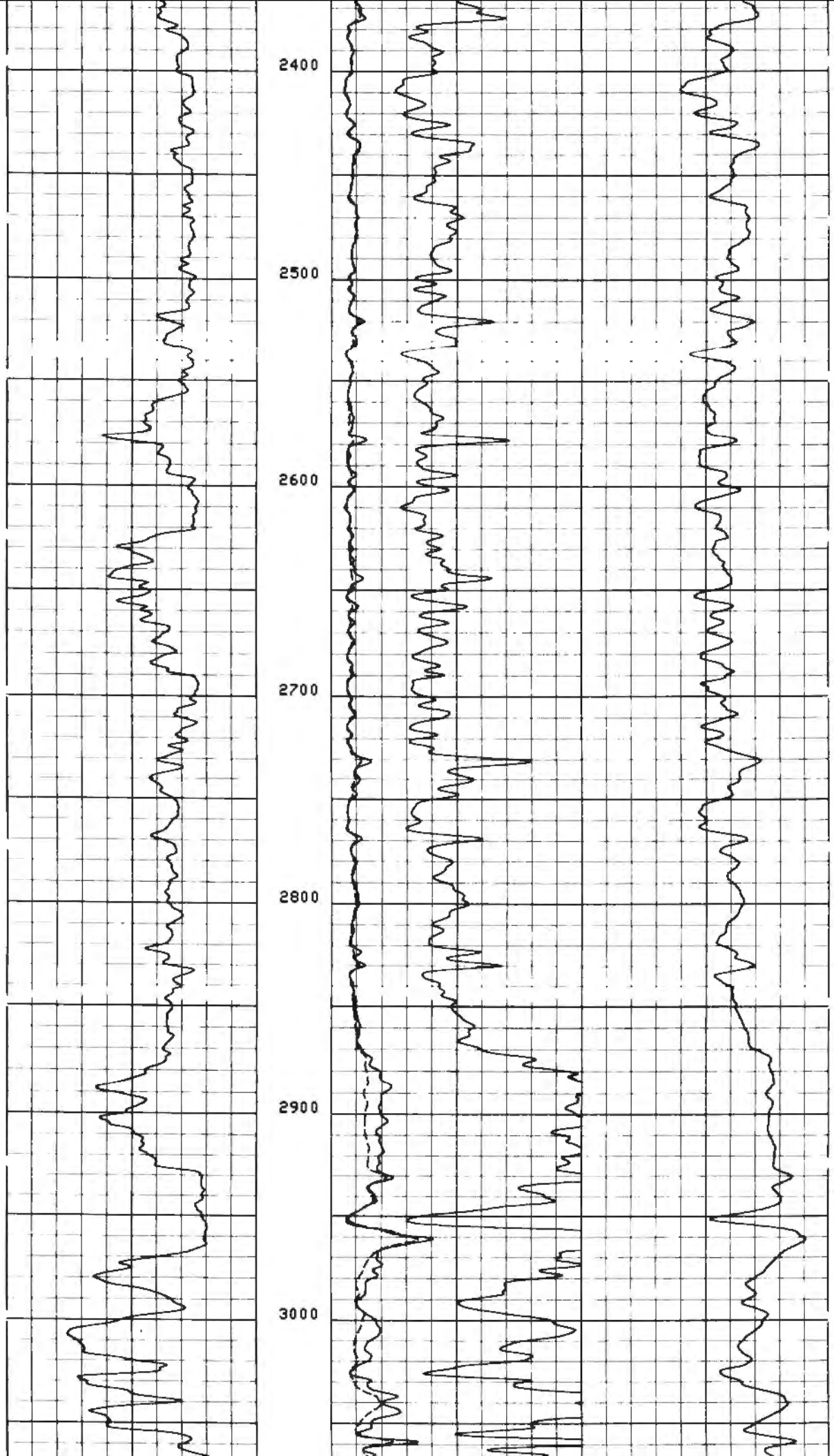
2200
2300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2700
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2900
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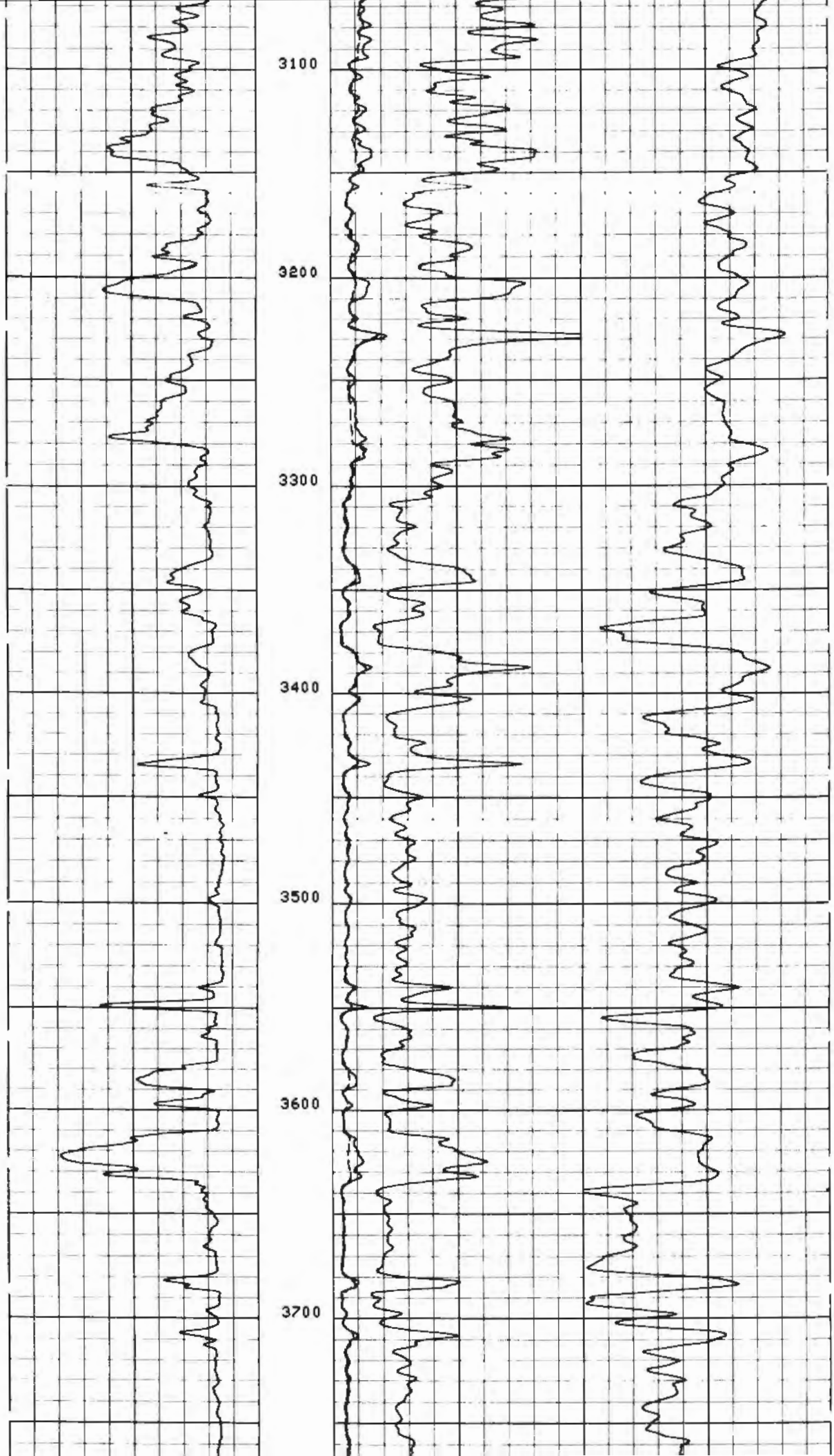
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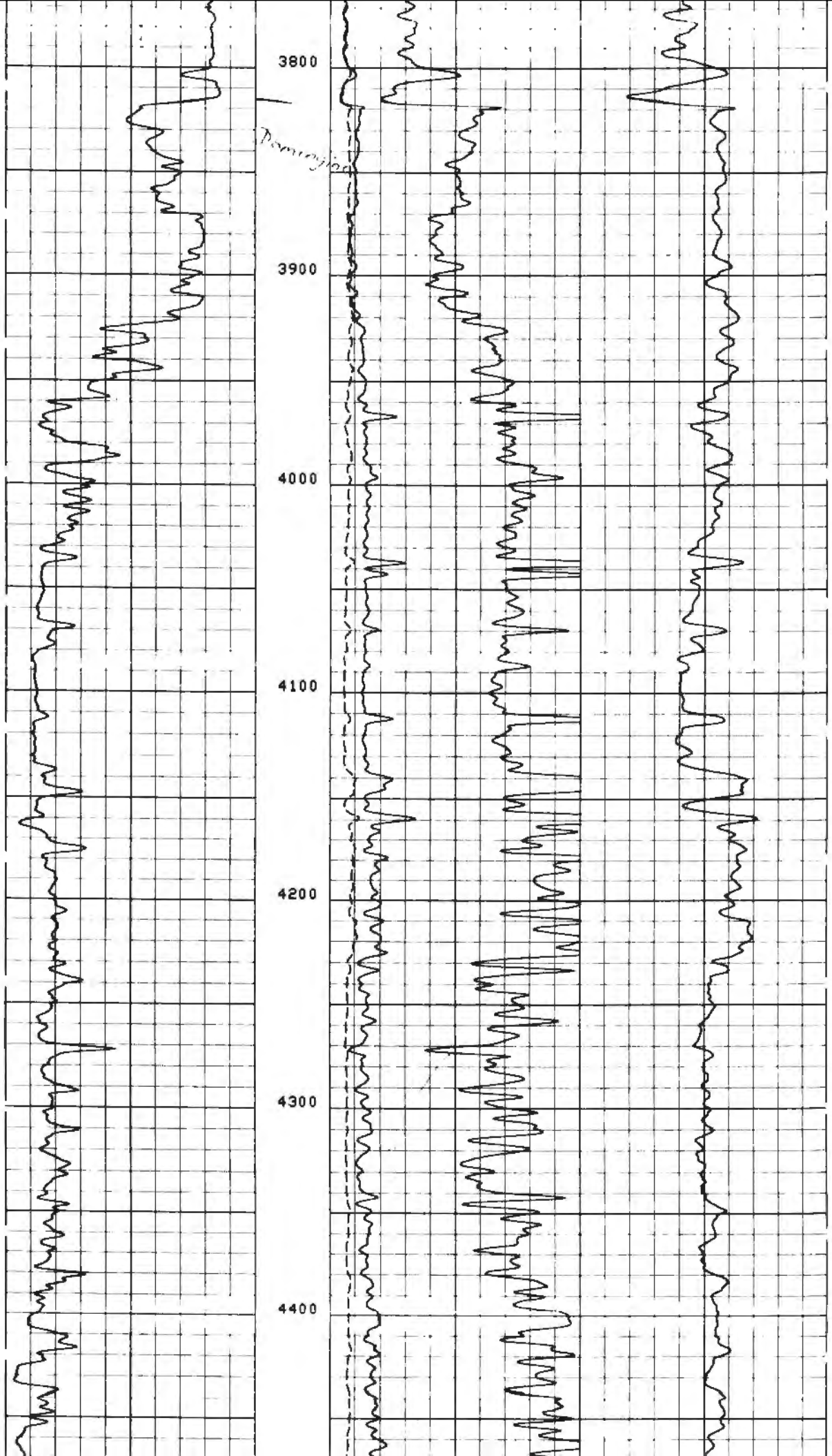
3500
3600
3700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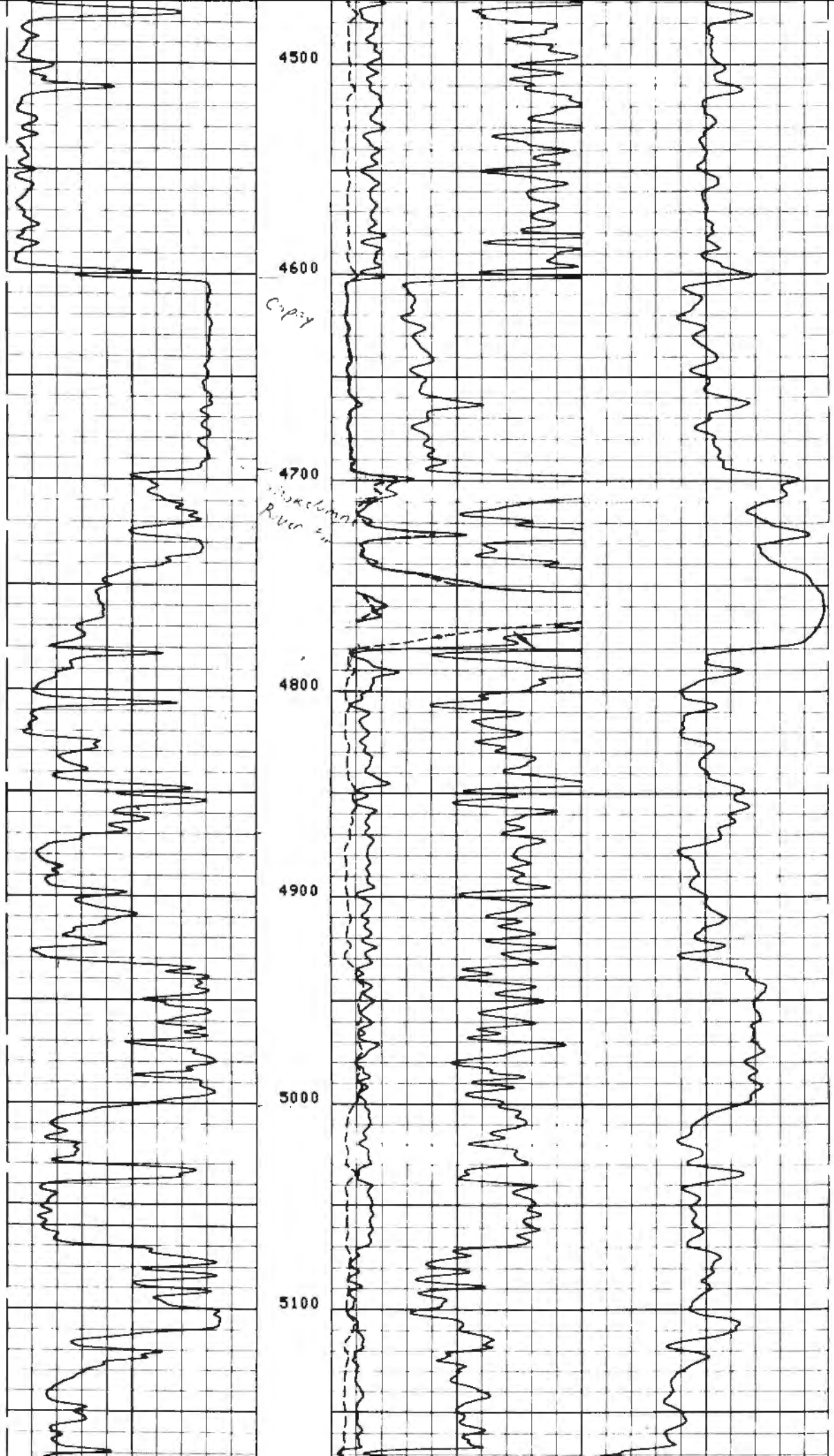
4400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4600
Copy
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Muskingum
River
4800
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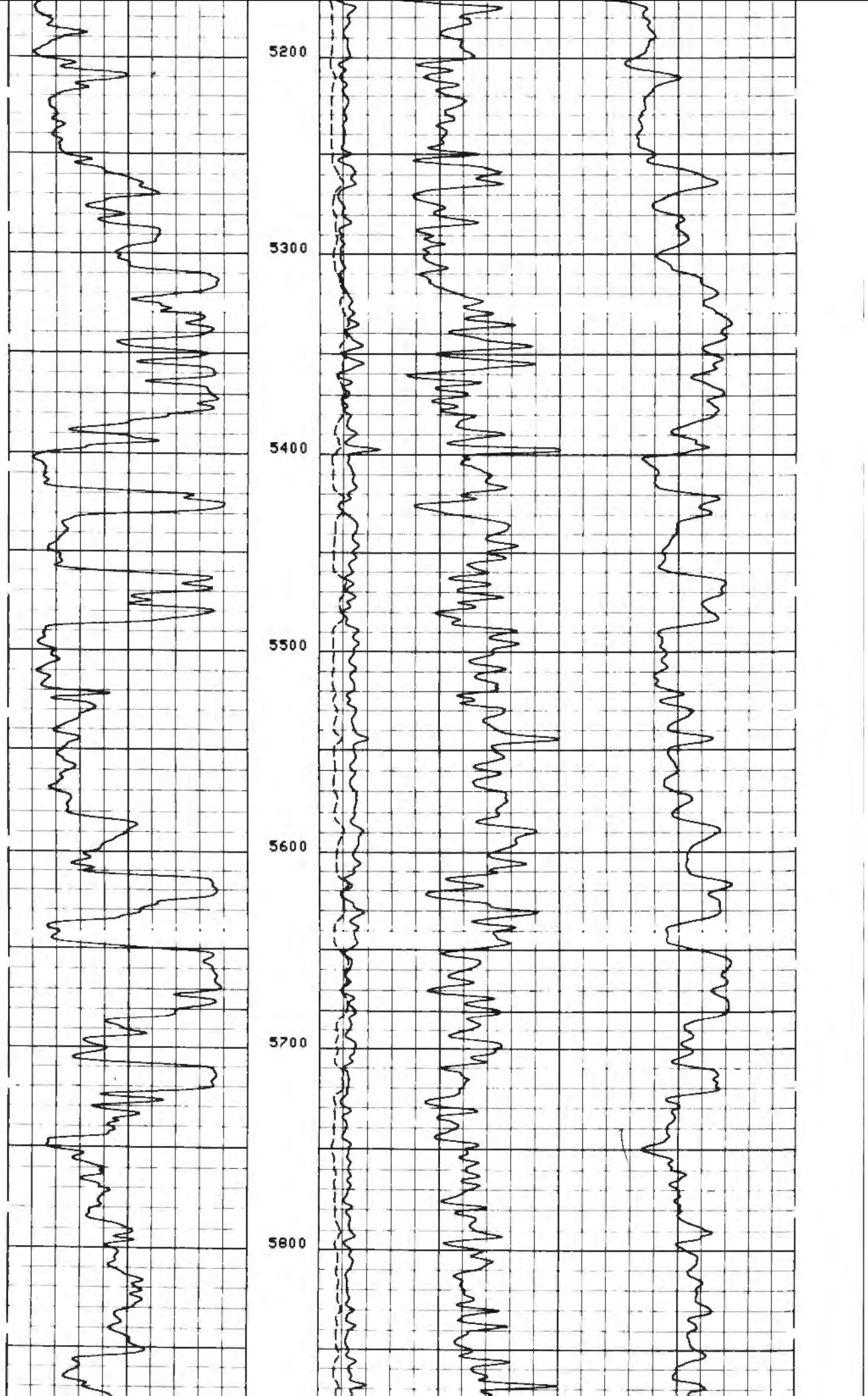
5000
5100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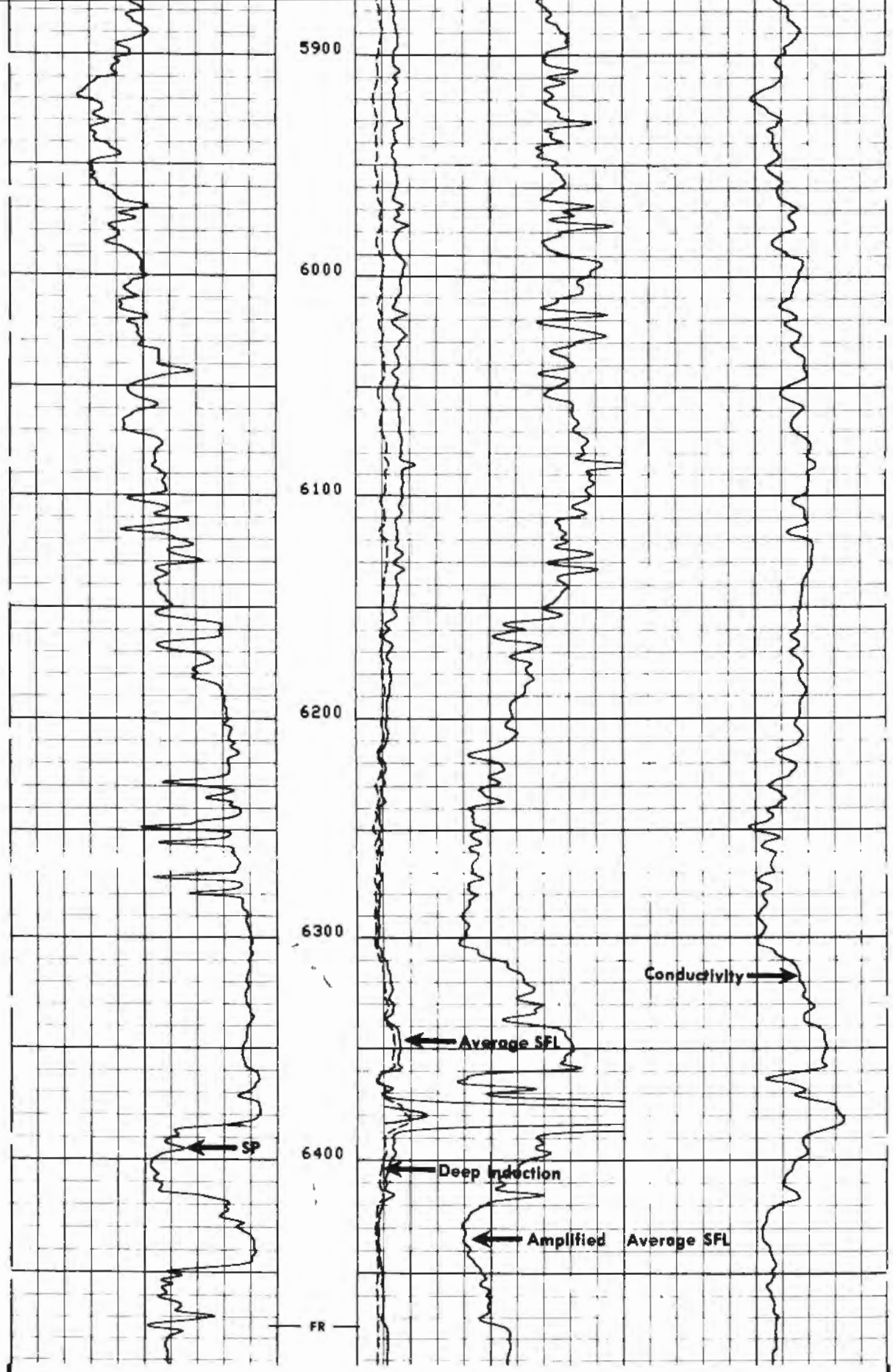
5800



FILE 101 12-SEP-85 15:08
DATA ACQUIRED 12-SEP-85 13:36

	ILD (OHMM) 0.0 30.000 SFLA(OHMM) 0.0 6.0000	
SP (MV)	SFLA(OHMM)	CILD(MMHO)

-100.0	0.0		0.0	30.000	1000.0	0.0

SENSOR MEASURE POINT TO TOOL ZERO

CBL	37.0	FEET	AMPL	37.0	FEET
TT3	33.3	FEET	TT4	32.3	FEET
TT1	36.0	FEET	TT2	37.0	FEET
CALI	56.1	FEET	SRAT	34.5	FEET
SFL	6.4	FEET	ILD	9.4	FEET
SP	2.5	FEET	ILM	5.7	FEET
TENS	2.5	FEET	SPAR	2.5	FEET
MOIS	28.8	FEET			

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
WSV1	WF1		DWS	16	
DSIN	5	US	DDEL	200	US
CDTS	100.000		DWCO	512	
DTF	189.000	US/F	DTM	56.0000	US/F
SBR	1.00000	DHMM	DSEC	4.40000	MMHO
FPHI	SPHI		MSEC	5.20000	MMHO
BS	7.82500	IN	BHS	OPEN	
PP	NORM		PO	0.0	F

Raymond G. Moresco
29 W. Banbury Dr.
Stockton, CA 95207
(209) 477-8371

Div. of Oil & Gas - Dist. 6
RECEIVED
JUN 24 1998
Sacramento, California

June 15, 1998

Robert A. Reid, Deputy Supervisor
Department of Conservation
Division of Oil, Gas & Geothermal-District 6
801 "K" Street 20th Floor MS 22
Sacramento, CA 95814-3530

Re: Moresco et al Unit A #1 Well Site Restoration

Dear Mr. Reid:

I am the landowner of the Moresco et al Unit A #1 well site. Both the Moresco and Piacentine wells are on acreage that I own and farm.

Recently, I was approached by Doug Eberts of Sierra Resources, the subject well's operator, and informed that your agency had directed Sierra to restore the site. Please be advised that I have asked Sierra to remove the production equipment while leaving the gravel pad in place. I have use of the pad to park farm equipment for servicing the fields. For your information, Sierra has agreed to pay for removing the pad at a later date if I so chose.

I appreciate your consideration of my needs.

Very truly yours,

Raymond G. Moresco

Raymond G. Moresco

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS AND GEOTHERMAL RESOURCE

REPORT OF WELL PLUGGING AND ABANDONMENT

District 6, (916) 322-1110

Sacramento, California
June 25, 1998

Mr. Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
P.O. Box 2788
Mammoth Lakes, CA 93546-2788

Your report of abandonment of well "Moresco Et Al Unit A" 1
API No. 077-20469, Sec. 28, T. 3N, R. 5E, M.D. B. & M.,
King Island Gas field, San Joaquin County,
dated 4/02/98, received 4/06/98, has been examined in conjunction with records filed in this office. We have determined that all of the requirements of this Division have been fulfilled relative to plugging and abandonment of the well, removal of well equipment and junk, and the filing of well records.

NOTES: 1. Surface plugging completed on 8/7/97.

2. Mr. Raymond G. Moresco (land owner) has taken over responsibility of pad per letter dated 6/15/98.

RAR:jv
Blanket Bond

WILLIAM F. GUERARD, JR.
State Oil and Gas Supervisor
By Robert A. Reid
Deputy Supervisor
ROBERT A. REID

OG159 (3/94/GSR1/2M)

DIVISION OF OIL AND GAS
CHECK [illegible]T - RECORDS RECEIVED AND WELL [illegible]US

Company _____ Well No. _____

API No. 077-20469 Sec. _____, T. _____, R. _____, _____ B.&M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	ABD 4/6/98
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Waterflood	
Abandoned - Oil		Steamflood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole		Air Injection	
Producing - Gas		Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas	X	LPG Injection	
Gas-Open to Oil Zone		Observation	
Gas Storage		Waterflood Source	

DATE 8/8/97 "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection Hold
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change ____ (F-OGD165) _____
2. Elevation change ____ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

MM

RECORDS NOT APPROVED
Reason: _____
SF

RECORDS APPROVED RAR 6/24/98
6/16/98 Letter from landowner agreeing to retaining the well pad

RELEASE BOND _____
Date Eligible _____
(Use date last needed records were received.)

MAP AND MAP BOOK 610

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (6/91/GSR1/5M)

CHECK L[illegible] - RECORDS RECEIVED AND WELL S[illegible]IS

Well No.



API No._____ Sec._____, T._____, R._____, _____B.&M.

WORK PERFORMED	STATUS	DATE
Drill_____ Redrill_____ Deepen_____	Producing_____"E" well Yes☐ No☐	
Plug_____ Alter Casing_____	Recompleted Producing_____	
Waterflood _____ Water Disposal_____	Waterflood _____	
Abandon_____	Water Disposal_____	
Other_____	Abandoned_____	
	Other_____	
	MAP AND BOOK_____ Engineer_____	

RECORDS FILED AND DATE Clerk_____

Summary_____

Log and Core_____

History_____

E-log_____

_____

Directional Survey_____

Other_____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location_____ Notice states_____

_____

_____

_____

_____

Elevation_____ Notice states_____

_____

_____

_____

Production Reports_____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection_____

Data Needed_____

Request Records_____ OGD170____

Correct records_____ OGD165____
(Specify)

EDP_____(OGD42A-1, 2) ___

CARDS_____

BOND_____

Hold_____ Reason_____

Release____ Date Eligible_____ OGD150____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection_____ Engineer____

FINAL LETTER_____ OG159____
and
File cleared _____ OGD121____

OGD2 (LONG BEACH)

Well: Moresco Unit "A" #1
API#: 04-077-20469
Field: King Island
S/T/R: S28-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

450 Fairway Drive #705
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 4/2/98

PLUG & ABANDONMENT HISTORY

DATE	REMARKS
8/05/97	MIRU Graham Rig #2. Ram on derrick failed, repair same and secure well for night.
8/06/97	Nipple down tree and nipple up BOPE. Test BOPE to 1500 psi. RIH with open ended 2-7/8" tubing to 4758'. Mix and equalize 30 sx neat class "G" cement plug. POOH to 4400' and reverse circulate clear with lease water. POOH ten (10) stands and secure well for night.
8/07/97	Trip in hole open ended 2-7/8" tubing and tag cement at 4602'. Change over hole to 73# drilling mud. Cement tag and mud up of hole witnessed and approved by D.O.G.G. personnel. POOH laying down tubing. Rig up perforator and shot four (4) holes at 450'. RIH with tubing to 355'. Mix and pump 70 cubic feet of neat "G" cement. Close pipe rams and circulate cement behind 5-1/2" casing to cover base of fresh water. Pumped 43 cubic feet of cement away when pump locked up at 1900 psi (43 cubic feet in annulus and 27 cubic feet inside casing). Cement squeeze witnessed and approved by D.O.G.G. personnel. POOH and secured well for night.
8/08/97	Mix and equalize cement plug from 30' to surface. Weld on steel plate at 6". Cement plug and steel plate witnessed and approved by D.O.G.G. personnel. Rig down and release Graham Rig #2.

Div. of Oil & Gas - Dist. 6
RECEIVED
APR 0 6 1998
Sacramento, California



SIERRA RESOURCES
INCORPORATED

Records will be here by 4-3-98

FACSIMILE COVER SHEET

DATE: 3/17/98

TO: ROBERT HABEL

FROM: DOUG EBERTS

TIME: 1 AM (PM)

PAGES: 3 INCLUDING THIS COVER SHEET

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL (760) 934-3356 AND ASK FOR JEANIE.

MESSAGE: RECIEVED YOUR 3/9th LTR ON FRIDAY. SORRY I'M LATE, I THOUGHT WE SENT IN A P&A HISTORY @ THE TIME OF WORK. WE MOVED 11/97 & YOUR NOTICES WERE VERY LATE IN ARRIVING DUE TO SLOW P.O. REROUTING. REGARDLESS, I WILL PREPARE THE REQUIRED P&A HISTORY & FED. EX. TO YOU SO YOU HAVE ON HAND BEFORE WEEKS END.

SORRY FOR THE LAPSE,

Doug

P.O. BOX 2788 • MAMMOTH LAKES, CA 93546-2788 • (760) 934-3356 • FAX (760) 934-5637

SIERRA RESOURCES
INCORPORATED

April 3, 1998

Robert S. Habel, Associate Engineer
Department of Conservation
Division of Oil, Gas & Geothermal-District 6
801 "K" Street MS 20-22
Sacramento, CA 95814-3530

Re: Moresco Et Al Unit A #1 Well History

Dear Mr. Habel:

Enclosed is the history you requested on the subject well. I apologize for the problems I had in getting this record to you in a timely manner and I sincerely appreciate your patience.

As the request was originally sent to our old address, **be advised that Sierra Resources has relocated our headquarters office to the address shown below.** I have included my new card for your records.

Please let me know if you have any questions or require additional information.

Very truly yours,

SIERRA RESOURCES, INC.

Doug Eberts

RDE:je

enclosures

Div. of Oil & Gas - Dist. 6
RECEIVED
APR 0 6 1998
Sacramento, California

P.O. BOX 2788 • MAMMOTH LAKES, CA 93546-2788 • (760) 934-3356 • FAX (760) 934-5637

STATE OF CALIFORNIA–THE RESOURCES AGENCY PETE WILSON, *Governor*

DEPARTMENT OF CONSERVATION
**DIVISION OF OIL, GAS,
AND GEOTHERMAL RESOURCES - DISTRICT 6**
801 K Street, MS 20 - 22
SACRAMENTO, CALIFORNIA 95814-3530
(916) 322-1110
TDD (916) 324-2555
TELEFAX (916) 323-0424

March 9, 1998

Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
P.O. Box 2788
Mammoth Lakes, CA 93546-2788

Subject: Past Records Due

Dear Mr. Eberts:

The California Division of Oil, Gas, and Geothermal Resources sent you a Notices of Records Due (see attached) regarding the well "Moresco Et Al Unit A" 1. The Division has yet to receive the requested records as required by Section 3215, Division 3 of the Public Resources Code.

Failure to file these records is a violation of law punishable by a substantial civil penalty as provided by Section 3236.5 of the Public Resources Code. This office may start the procedure to issue Sierra Resources, Inc. a civil penalty if the well records are not received by March 23, 1998.

If you are unable to comply within this time frame, or have any questions, please contact me at (916) 322-1110.

Sincerely,

Robert S. Habel
Associate Engineer

Attachment

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

NOTICE OF RECORDS DUE

SECOND NOTICE

Sacramento, California
January 27, 1998

Mr. Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
Truxtun Avenue, Suite 250
Bakersfield, CA 93309

In accordance with Division 3 of the Public Resources Code of California, the following records are due, covering the abandonment **(Notice dated** August 11,97**)**

of your well(s) "Moresco Et Al Unit A" 1

King Island Gas Field, San Joaquin County, Sec. 28, T. 3N R. 5E, M.D.B. & M.

RECORDS: *Records are due within 60 days after completion, suspension, or abandonment of any well, or upon completion of additional work in any well. Records shall be submitted in duplicate. Division forms must be signed in the spaces provided.*

OIL AND GAS OPERATION

- ☐ Well summary (Form OG 100)
- ☐ Core or sidewall sample (Form OG 101)
- ☒ History (Form OG 103)

GEOTHERMAL OPERATION

- ☐ Well summary (Form OGG 100)
- ☐ Core or sidewall sample (Form OGG 101)
- ☐ History (Form OGG 103)

LOGS, TESTS, AND SURVEYS: *All logs, tests and surveys are due within 60 days after completion, suspension, or abandonment of any well, or upon completion of additional work in any well. Logs, tests and surveys shall be submitted in duplicate.*

- ☐ Electric log (1" = 50 ft.)
- ☐ Velocity survey
- ☐ Water analysis
- ☐ R/A survey
- ☐ Directional survey
- ☐ Mud log
- ☐ Oil and/or gas analysis
- ☐ Spinner survey
- ☐ Dipmeter (computed)
- ☐ Pressure measurements (flowing and static)
- ☐ Temperature survey
- ☐ Cement bond log

wo copies of all logs run on each well

- ☐ Other _____

REPORTS FOR THE MONTH OF : *Production, oil and gas disposition, and injection reports are due on or before the 30th day of each month for the preceding calendar month. Signatures must be provided as required on Division forms.*

OIL AND GAS OPERATION

- ☐ Production and disposition reports (Form OG 110 or computer report)
- ☐ Injection reports (Form OG 110B or computer report)

GEOTHERMAL OPERATION

- ☐ Production reports (Form OGG 110)
- ☐ Injection reports (Form OGG 110B)

NAME	TITLE
Jennie M. Vona	Office Assistant

SIGNATURE Jennie M Vona

TELEPHONE NUMBER (916) 322-1110

OG170 (9/88/DWRR/5M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

No. T 697-155

REPORT ON OPERATIONS

District 6, (916) 322-1110

Attn: Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
Truxton Avenue, Suite 250
Bakersfield, CA 93309

Sacramento, California

August 11, 1997

Your operations at well "Moresco et al Unit A" 1, API No. 077-20469,
Sec. 28, T. 03N, R., 5E, B. & M. King Island Gas
Field, in San Joaquin County,
were witnessed on 08/07/97. K. Lundy, representative of
the supervisor, was present from 0800 to 0930.
There were also present G. Santos, drilling foreman.
Present condition of well: 8 5/8" cem. 723', 5 1/2" cem. 4999', cp @ 450', perf. @ ints. 4760'-4698'. T.D. 6500'. Plugged w/cem. 4758'-4602' & 450'-190'.

The operations were performed for the purpose of abandonment.

DECISION:

The plugging operations as witnessed and reported are approved.

Blanket Bond
MFC:sr

William F. Guerard Jr., State Oil and Gas Supervisor

By Robert A. Reid
Deputy Supervisor
Robert A. Reid

OG109 (9/89/GSR1/5M)

(ASD)

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CEMENTING/PLUGGING MEMO

Operator SIERRA RES, INC. Well No. "MORESCO ET AL UNIT A-1"
API No. 077-20469 Sec. 28, T. 3N, R. 5E, MD B&M
Field KING ISLAND GAS, County SAN JOAQUIN. On 8-7-97,
Mr / Ms. K. LUNDY, representative of the supervisor, was present from 0800 to 0930.
There were also present MR C. SANTOS, D.F
Casing record of well: 8 5/8" CEM 723'; 5 1/2" CEM 4999', CP @ 450', PERF @ INTS 4760'-4698'. T.D. 6500'. PLUGGED W/CEM. 4758'-4602' & 450'-190'.

The operations were performed for the purpose of ABO

☒ The plugging/cementing operations as witnessed and reported are approved.

☐ The location and hardness of the cement plug @ _____' are approved.

Hole size: _____" fr. _____' to _____', _____" to _____' & _____" to _____'

Casing				Cemented			Top of Fill		Squeezed Away	Final Press.	Perfs.
Size	Wt.	Top	Bottom	Date	MO-Depth	Volume	Annulus	Casing			

Casing/tubing recovered: 5 1/2" shot/cut at 450' KL; _____' pulled fr. _____';
_____" shot/cut at _____', _____', _____' pulled fr. _____'.

Junk (in hole): _____

Hole fluid (bailed to) at _____'. Witnessed by _____

Mudding	Date	bbls.	Displaced	Poured	Fill	Engr.
74#	8/7		✓			KL

Cement Plugs		Placing	Placing Witnessed		Top Witnessed			
Date	Sx./cf	MO & Depth	Time	Engr.	Depth	Wt/Sample	Date & Time	Engr.
8/6	30	TBG @ 4758	—	—	4602	STK TBG	8/7 0800	KL
8/7	70	HOLES @ 450	FAILED	TO CALL	190	COTAG	—	—

BFW @ 400

OGD10 (11/93/GSR1/5M)

4760-4598

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CEMENTING/PLUGGING MEMO

Operator SIERRA RES, INC. Well No. IRESCO ETAL UNIT A-1

API No. 077-20469 Sec. 23, T. 3S, R. 5E, MD B&M

Field KLEY ISLAND GAS, County SAN JOAQUIN. On 8-7,

(Mr) / Ms. K. FUNGY, representative of the supervisor, was present from 0800 to 0930.

There were also present MR. C. SANTOS, O.F

Casing record of well: 8 5/8" CEM 723'; 5 1/2" CEM 4999', CPC 450', CERF @ INTS 4760'-4698'. T.D. 6500'. PLUGGED W/CEM. 4758'-4602' & 450'-190'.

The operations were performed for the purpose of AGO

☒ The plugging/cementing operations as witnessed and reported are approved.

☐ The location and hardness of the cement plug @ _____' are approved.

Hole size: _____" fr. _____' to _____'; _____" to _____' & _____" to _____'

Casing				Cemented			Top of Fill		Squeezed Away	Final Press.	Perfs.
Size	Wt.	Top	Bottom	Date	MO-Depth	Volume	Annulus	Casing			

Casing/tubing recovered: 5 1/2 shot/cut at 450' (TC); _____' pulled fr. _____';

_____" shot/cut at _____'; _____'; _____' pulled fr. _____'.

Junk (in hole): _____

Hole fluid (bailed to) at _____'. Witnessed by _____

Mudding	Date	bbls.	Displaced	Poured	Fill	Engr.
74#	8/7		✓			JLC

Cement Plugs		Placing	Placing Witnessed		Top Witnessed			
Date	Sx./cf	MO & Depth	Time	Engr.	Depth	Wt/Sample	Date & Time	Engr.
8/6	30	TOC 4738	—	—	4602	— TIC TOC	8/7 0800	JLC
8/7	70	HOLE 450	FAILED	TO CALL	190	COTAG	—	—

RFW @ 400

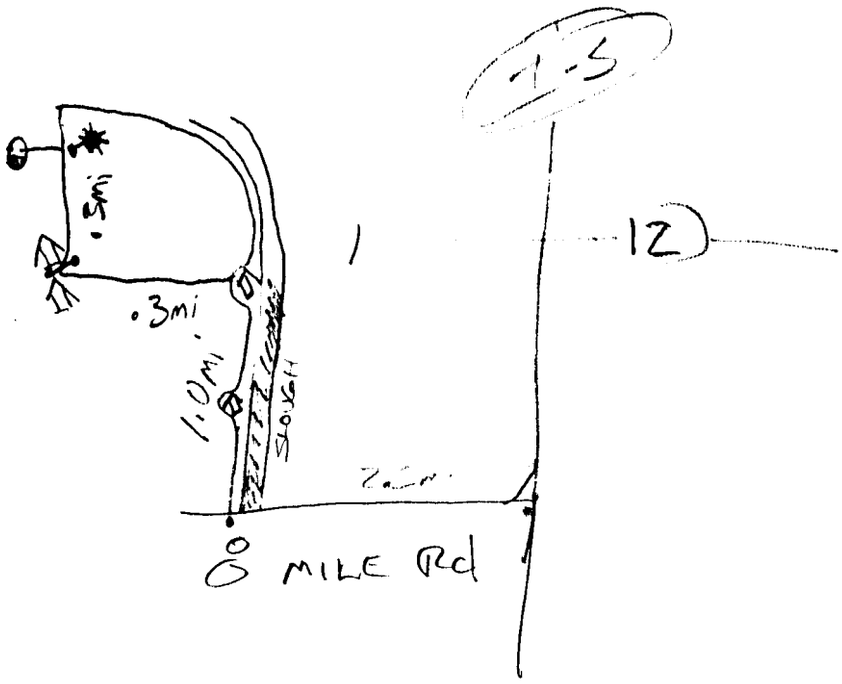
OGD10 (11/93/GSR1/5M)

4760-4598

GPS 8-7-97

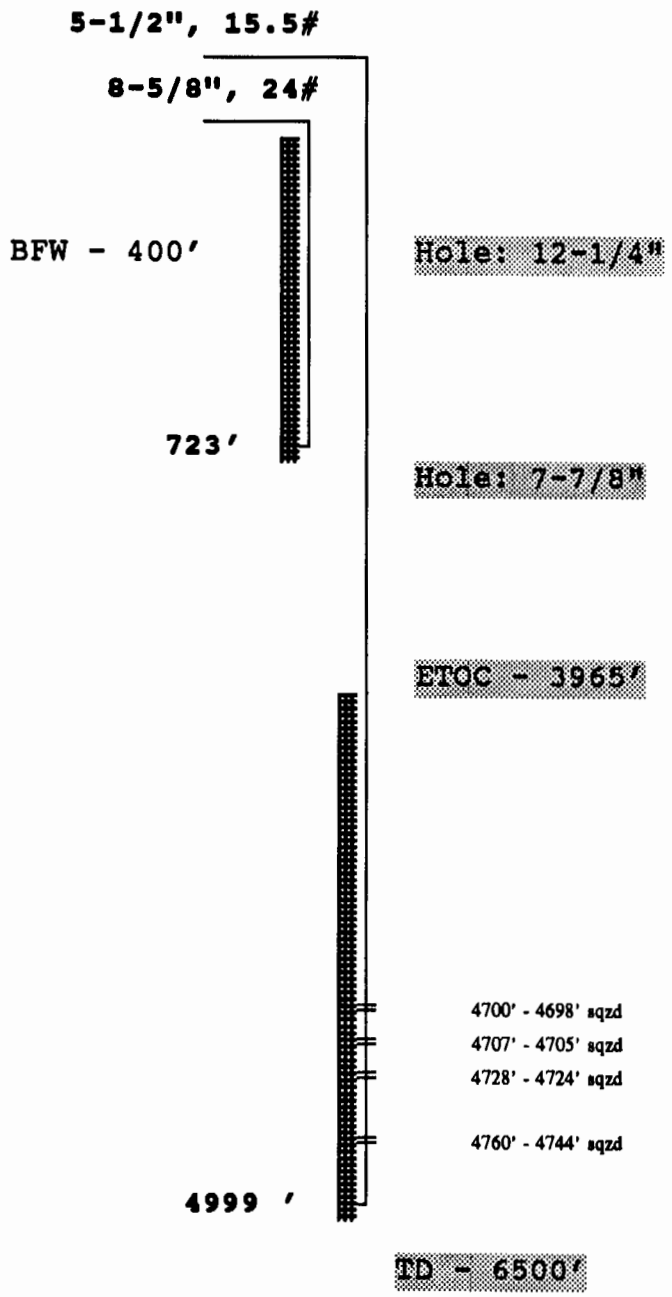
"PLACENTINE" 1-27

077-20484



"Moresco et al Unit A" 1
077-20469

Spud Date:9/6/85
RSH - August 8, 1997
Well Class - Development



KEY

|	Casing		Cement
+	WSO Hole	⊕	Fish
≠	Perf.		Bridge plug/Retainer

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 697-301

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
10 (new pool code)
10 (old pool Code)

Attn: Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
Truxtun Avenue, Suite 250
Bakersfield, CA 93309

Sacramento, California
August 8, 1997

Your proposal to abandon well "Moresco et al Unit A" 1, A.P.I. No. 077-20469, Section 28, T. 3N, R. 5E, M.D.B.& M., King Island Gas field, Any area, Mokelumne River pool, San Joaquin County, dated 7/30/97, received 8/1/97 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" 2M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. The equipment shall be operated by a nonmanual activating system. See Manual M07 and attached sheet.
2. Wire line operations are conducted through at least a 2 M lubricator.
3. All portions of the hole not plugged with cement are filled with inert mud fluid having a minimum density of 70 lbs./cu. ft and a minimum gel-strength (10 min.) of 20 lbs./100 sq. ft.
4. The hole is plugged with cement from 4760' to 4598'.
5. The 5-1/2" casing is perforated at 450 ' and a minimum of 58 ft^3 (300 linear feet) of cement shall be squeezed through the perforations.
6. The hole is plugged from 450 ' to 350 ', and from 30' to 5'.
7. All annuluses between casings are filled with cement from 30' to 5'.
8. **THIS DIVISION IS NOTIFIED:**
   a. To witness the location and hardness of the cement plug at 4598 '.
   b. To witness the cement squeeze at 450 '.
   c. To witness the placing of the surface plug.

NOTE:
1. All casing must be removed from at least 5 feet below ground level.
2. The cleanup of the wellsite must be approved by the Division before the Report of Final Well Abandonment (Form OG159) can be issued. ***Please contact this office for site inspection after the wellsite cleanup work has been completed. PURSUANT TO THE CALIFORNIA CODE OF REGULATIONS, WELL SITE RESTORATION MUST BE COMPLETED WITHIN 60 DAYS FOLLOWING PLUGGING AND ABANDONMENT OF THE WELL.***

Blanket Bond
RSH:sr

Engineer Robert S. Habel

Phone (916) 322-1110

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (2/95/GSR1/5M)

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

Div. of Oil & Gas - Dist. 6
RECEIVED
AUG 0 1 1997
Sacramento, California

Notice of Intention to Abandon Well

File in Duplicate

FOR DIVISION USE ONLY			
CARDS	BOND	FORMS	
		OGD114	OGD121
✓	BM		✓

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

In compliance with Section 3229, Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon well Moresco "A" #1, API No. 04-077-20469, Sec. 28 T. 3N, R. 3E, MD B.&M., Rio Blauco Field, San Jouquin County, commencing work on 8/1/, 1997.

The present condition of the well is:

1. Total depth 4735'
2. Complete casing record, including plugs and perforations (present hole)
   See back of page
3. Last produced 3/95 -- 50 25
   (Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)
   (or)
4. Last injected _____
   (Date) (Water, B/D) (Gas, Mcf/D) (Surface pressure)

Additional data for dry hole (show depths):

5. Oil or gas shows
6. Stratigraphic markers
7. Formation and age at total depth
8. Base of freshwater sands _____

9. Is this a critical well according to the definition on the reverse side of this form? ☐ Yes ☒ No

The proposed work is as follows:

1. MIRU w/o rig.
2. RIH to 4760' & equalize 30 sx cmt.
3. POH to 4400' reverse clear. WOC. Tag TOC.
4. Displace lease water w/mud.
5. Equalize cmt plug across BFW.
6. Equalize cmt plug 30' to surface.
7. Weld on steel plate @ 6'.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address PO Box 102 (Street)
Sutter (City) CA (State) 95982 (Zip)
Telephone Number (916) 674-8121 (Area Code) (Number)

Sierra Resources (Name of Operator)
By Michael Phillips (Print Name)
(Signature) 7/30/97 (Date)

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720 (a), "Critical well" means a well within:

(1) 300 feet of the following:
   (a) Any building intended for human occupancy that is not necessary to the operation of the well; or
   (b) Any airport runway.

(2) 100 feet of the following:
   (a) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
   (b) Any navigable body of water or watercourse perennially covered by water;
   (c) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
   (d) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgement or upon written request of an operator. This written request shall contain justification for such an exception.

8 5/8" 24# J-55 @ 723' (cmt to surface)
5 1/2" 15.5# K-55 @ 5000' (TOC 4120')

Effective Perforations:
4744'-4752'

Ineffective Perforations - squeezed:

4744'-4760'	4705'-4707'
4744'-4750'	4724'-4728'
4698'-4700'	All sqz

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. 04 7-20469 Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	4/5/97
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	____	Water Disposal	____
Idle - Oil	____	Waterflood	____
Abandoned - Oil	____	Steamflood	____
Drilling - Idle	____	Fire Flood	____
Abandoned - Dry Hole	____	Air Injection	____
Producing - Gas	____	Gas Injection	____
Idle - Gas	X	CO_2 Injection	____
Abandoned - Gas	____	LPG Injection	____
Gas-Open to Oil Zone	____	Observation	____
Gas Storage	____	Waterflood Source	____

DATE 2/6/97 "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 ✓
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

WORK PERFORMED

Drill _____ Redrill _____ Deepen _____

Plug _____ Alter Casing _____

Waterflood _____ Water Disposal _____

Abandon _____

Other _____

STATUS **DATE**

Producing _____ "E" well Yes ☐ No ☐

Recompleted Producing _____

Waterflood _____

Water Disposal _____

Abandoned _____

Other _____

MAP AND BOOK _____ Engineer _____

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____
(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

(Check One)

End premium year _____

Release requested _____

Bond superseded _____

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____
and

File cleared _____ OGD121 _____

Well: Moresco Unit "A" #1
API#: 04-077-20469
Field: King Island
S/T/R: S28-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

5601 Truxtun Avenue
Suite 250
Bakersfield, CA 93309
(805) 631-8378
FAX (805) 631-9761

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 4/30/97

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 05 1997
Sacramento, California

RECOMPLETION HISTORY

DATE	REMARKS
2/04/97	MIRU Oil Well Service rig. R/U on tree. Pump in well with lease water and kill same. Unable to fill hole with 70 Barrels of lease water. N/D Tree and N/U BOP's with 2-7/8" rams and test same. Released packer and attempt to circulate - no returns. POOH slowly while filling hole. Laid down packer and stood back tubing. Well kicked while running back in hole with tubing. Reverse circulate well and kill same with lease water. Secured well for night.
2/05/97	Opened well - no pressure. Continued measuring in hole with tubing, tagging fill at 4672'. Circulated and spudded through bridge and lost returns. RIH to 4,720' and tagged very solid fill - no returns. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement plug and displace with 26 bbls of lease water - no returns. CIP @ 9:32 am. POOH with tubing, pumping 10 bbls water every 1500'. Made up drilling BHA and secured well for night.
2/06/97	Trip in hole with bit and BHA on tubing string. Tag cement @ 4620'. R/U power swivel and drill out soft cement to 4715'. Circulate clean and test perforations @ 4698'- 4700' & 4705'- 4707 to 1000 psi, test held. Continue drilling out cement to 4735' and test perforations @ 4724'- 4728' to 1000 psi, test held. Continue drilling on EZSV retainer @ 4735'. Lost circulation and retainer began moving down hole to top of squeezed perforations @ 4744'- 4750'. POOH, measuring out and stand back BHA. RIH with open ended tubing to 4744'. Mix and pump 50 sx neat "G" cement plug and displace with 25 bbls of lease water - no returns. CIP @ 3:25 pm. POOH while filling tubing with lease water. Pressure test squeeze to 1000 psi, test held. Secured well for night.

Div. of Oil & Gas - Dist.
RECEIVED

MAY 0 5 1997

Sacramento, California

2/07/97 Trip in hole with bit and BHA on tubing string. Tag cement stringers @ 4198'. R/U power swivel and drill out soft cement from 4198' to 4715'. Circulate clean, pull five stands and pressure up to 1000 psi. Secured well for night to allow cement to harden.

2/08/97 Run to bottom with bit and BHA on tubing string. Tag cement @ 4715'. R/U power swivel and drill out firm cement from 4715' to 4729'. Circulate clean and test to 1000 psi, test held. Continue drilling out cement to 4744' with full returns. Begin drilling on EZSV retainer @ 4744', lost partial returns. Continue cleaning out to 4881' with partial returns. POOH, measuring out and stand back BHA. RIH with open ended tubing to 4788'. Mix and pump 40 sx neat "G" cement plug and displace with 26 bbls of lease water. CIP @ 4:10 pm. POOH to 3858' and reverse circulate clean. Pressure up to 2500 psi and secured well for night to allow cement to harden.

2/09/97 Waiting on cement.

2/10/97 Waiting on cement.

2/11/97 POOH and M/U BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4573'. R/U power swivel and drill out firm cement from 4573' to 4772'. Circulate and clean out to 4915'. Pressure test squeeze to 1000 psi, test held. Secured well for night.

2/12/97 POOH, laying down BHA. Make up casing scraper and TIH to 4800'. Make up 5-1/2" x 2-7/8" "Big Bore" R-3 packer and TIH with production setting as before. Set production packer @ 4647' w/ 12,000# in compression. Test packer to 1000 psi on casing and land tubing. N/D BOP's, N/U and test tree. Swab fluid down to 2000'. Rig down, release rig and move same to Piacentine 1-27 well to begin workover. Note: Operations temporarily suspended to allow cement to cure following squeeze work.

3/08/97 R/U Halliburton wireline and test wireline lubricator. Run TMDL pulsed neutron log from 4870'- 4540' to determine residual gas saturations through productive interval. **Well found to be depleted -- suspended operations awaiting P&A.**

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

PERMIT TO CONDUCT WELL OPERATIONS

No. P 697-021
351 (field code)
00 (area code)
10 (new pool code)
10 (old pool Code)

Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
5601 Truxtun Avenue, Suite 250
Bakersfield, CA 93309

Sacramento, California
January 21, 1997

Your proposal to rework well "Moresco et al Unit A" 1, A.P.I. No. 077-20469, Section 28, T. 3N, R. 5E, M.D.B.& M., King Island Gas field, Any area, Mokelumne River pool, San Joaquin County, dated 1/14/97, received 1/17/97 has examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 2M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 2 M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.

Blanket Bond
RSH:sr

Engineer Robert S. Habel

Phone (916) 322-1110

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

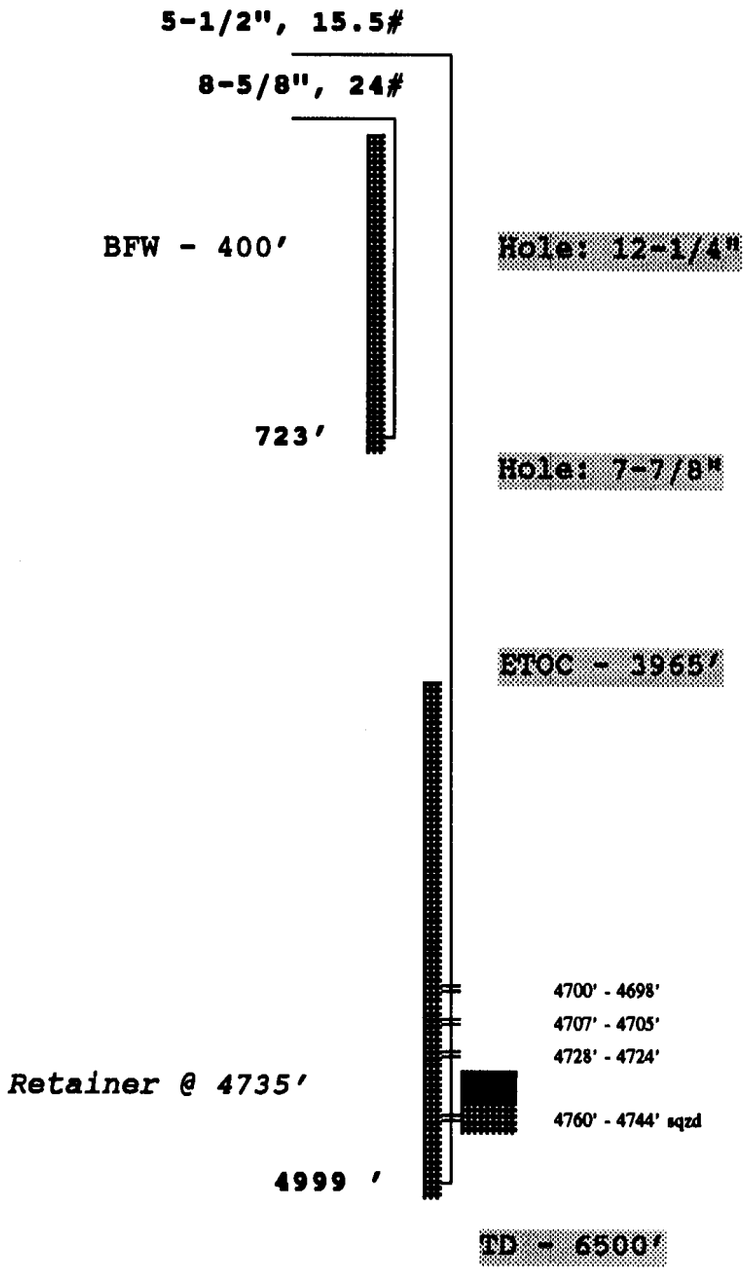
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (2/95/GSR1/5M)

"Moresco et al Unit A" 1
077-20469

Spud Date:9/6/85
RSH - January 21, 1997
Well Class - Development



KEY

|	Casing	▓	Cement
┼	WSO Hole	⊕	Fish
╪	Perf.	■	Bridge plug/Retainer

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Div. of Oil & Gas - Dist. 6
RECEIVED
JAN 17 1997
Sacramento, California

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	✓	

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well MORESCO etal Unit "A"#1 (Well designation), API No. 04-077-20469

Sec. 28, T. 3N, R. SE, ___B. & M., RIO BLANCO Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 6500'
   PBTD 4735' (EZSV RETAINER)

2. Complete casing record, including plugs and perforations (present hole)
   8 5/8" 24# K-55 ST&C 8RD. Casing @ 723'
   5 1/2" 15.5# K-55 LT&C 8RD. Casing @ 5000'

   PERFORATIONS: 4744-60' (squeezed)
   4744-50' (" ")
   4698-4700', 4705-4707' & 4724-4728' (open)

3. Present producing zone name MOKELUMNE ; Zone in which well is to be recompleted MOKELUMNE

4. Present zone pressure ± 1500 psi (est) ; New zone pressure + 2000 psi (est)

5. Last produced 3/95 (Date) | -0- (Oil, B/D) | 25 (Water, B/D) | 50 (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) | ___ (Water, B/D) | ___ (Gas, Mcf/D) | ___ (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

Recomplete to deeper zone within Mokelumne Sand. Present interval watered out. See detailed workover procedure attached.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 5601 Truxtun Ave. Ste. 250 (Street)
Bakersfield (City) CA (State) 93309 (Zip)
Telephone Number (805) 631-8378
Fax Number (805) 631-9761

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name - Printed)
Robert D. Eberts (Name - Signature) 1/14/97 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

MORESCO UNIT "A" #1
WORKOVER PROGRAM
JANUARY 14, 1997

Div. of Oil & Gas - Dist. 6
RECEIVED
JAN 17 1997
Sacramento, California

WELL INFORMATION

API No: 04-077-20469 FIELD: King Island

ELEVATION: All measurements from KB (10.2' above GL)
Elevation @ GL = 7.8'

TD: 6500' PBTD: EZSV Retainer @ 4735'

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 723'

5-1/2" 15.50#, K-55 LT&C csg. from surface to 5000' cemented with 155 sx (TOC @ 4120')

PACKER/TUBING: Baker 2-7/8" x 5-1/2" Model R-3 DG set @ 4672'
151 jts 2-7/8" 6.5# J-55 8rd EUE

EXISTING PERFORATIONS: 4744'- 4760' (squeezed)
4744'- 4750' (squeezed)
4698'- 4700' (open)
4705'- 4707' (open)
4724'- 4728' (open)

BOTTOM HOLE PRESSURE DATA: ± 1500 psi (current zone)
± 2000 psi (new zone)

PROPOSED PERFORATIONS: 4744'- 4749' DIL

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. MIRU rig. R/U on tree. Pump in well with lease water and kill same. Fill tubing annulus as required. N/D tree and N/U BOP's. Note: Send in tree to Cameron's Woodland shop to service and repair valves and Hi/Lo safety valve. Call Ves Cash or Jerry @ (916) 666-4144.

2. Release packer and circulate out. POOH slowly, keeping hole full and L/D tubing.

3. RIH open ended with work string. Reverse circulate clean to top of EZSV retainer @ 4735'. R/U cementers and test lines and manifold to 3000 psi. Spot 200" cement plug and pull tubing to ± 4400'. Reverse circulate clean above cement plug.

MORESCO UNIT "A" #1 WELL
WORKOVER PROGRAM
JANUARY 14, 1997

Div. of Oil & Gas - Dist. 6
RECEIVED
JAN 17 1997
Sacramento, California

4. Bradenhead squeeze perforations 4698'- 4700', 4705'- 07' & 4724'- 28' to 1000 psi over initial injection pressure (do not exceed 2500 psi). POOH with work string and secure well for night.

5. Trip in hole with bit and BHA on work string. Tag cement and drill out same to below 1st and 2nd set of perforations @ 4698'- 4700' & 4705'- 4707'. Circulate clean and test perforations to 1000 psi. Continue drilling out cement and test 3rd set of perforations @ 4724'- 4728' as before. Re-squeeze if necessary.

6. Continue drilling out cement and EZSV retainer @ 4735'. Clean out to ± 4850' to provide adequate rathole. Circulate clean and POOH, laying down work string and BHA.

7. R/U Schlumberger wireline. Make gauge ring/junk basket run to ± 4700'. Run cased hole neutron log from 4800'- 4600' to determine residual gas saturations through productive interval.

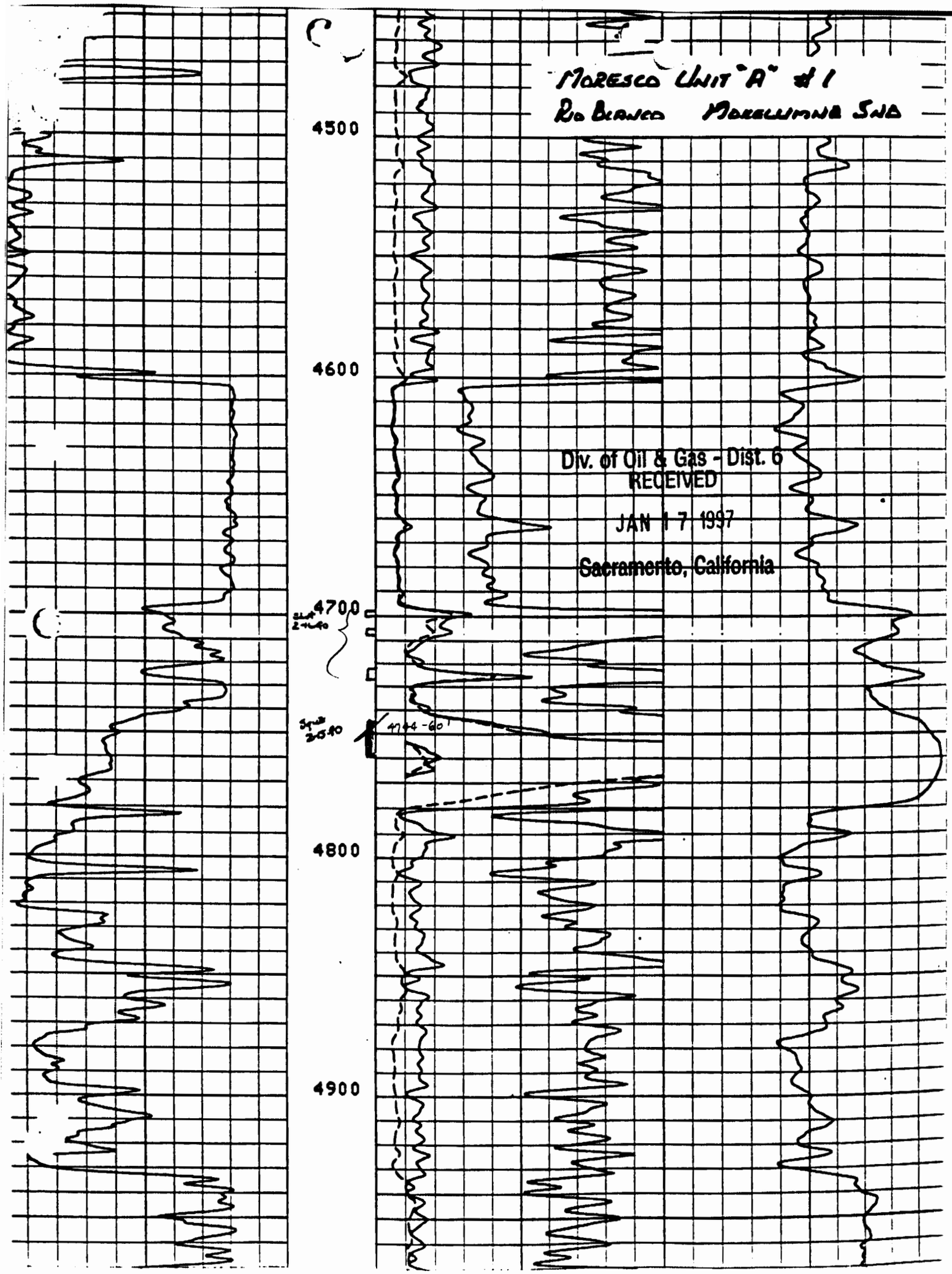
8. Trip in hole with redressed packer and production setting as before. Set production packer @ ± 4680'. Test packer to 1000 psi on casing.

9. N/D BOP's, N/U and test tree. Swab fluid down to 2000'. R/U and test wireline lubricator. GIH with 1-11/16" thru tubing perforating pivot gun, 4 shots/ft, 180 degree phasing. Perforate 4744'-4749' DIL. Swab well in if necessary.

   Note: Perforations could change depending on results of cased hole neutron log.

10. Unload and test well as needed. Obtain gas sample.

11. R/D and release rig.



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Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF PROPERTY AND WELL TRANSFER

Field or county	District
SAN JOAQUIN COUNTY	6
Former owner	**Date**
QUINTANA PETROLEUM CORPORATION	12/27/94

Name and location of well(s)

"MORESCO ET AL UNIT A" #1	28/3N/5E	007-20469
"PIACENTINE" 1-27	27/3N/5E	077-20484

Description of the land upon which the well(s) is (are) located

Date of transfer, sale, assignment, conveyance, or exchange	New owner	Type of organization
12/1/94	SIERRA RESOURCES, INC.	CORP.
	Address: 5601 Truxtun Ave. Suite 250, Bakersfield, CA 93309	Telephone No.: (805) 631-8378

Reported by: K. Briggs - QUINTANA

Confirmed by: R. Eberts - SIERRA

New operator new status (status abbreviation)	Request designation of agent
PA	
Old operator new status (status abbreviation)	**Remarks**
PA	

Deputy Supervisor	Signature
ROBERT A. REID	Robert A. Reid 12/28/94

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
Ab – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book		
Form ODG148			Notice to be cancelled		
New well cards			Bond status		
Well records			EDP files		
Electric logs					
Production reports					

DIVISION OF OIL AND GAS
CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. 077-20469 Sec. _____, T. _____, R. _____, _____ B.&M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Waterflood	___
Abandoned - Oil	___	Steamflood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	___	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Gas Storage	___	Waterflood Source	___

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED 5/7/90

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change ___ (F-OGD165) _____
2. Elevation change ___ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED
Reason: _____

RECORDS APPROVED CT 4/10/90

RELEASE BOND _____
Date Eligible _____
(Use date last needed records were received.)

MAP AND MAP BOOK n/c

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (8/87/DWRR/5M)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B.&M.

WORK PERFORMED	STATUS	DATE
Drill_____ Redrill_____ Deepen_____	Producing_____ "E" well Yes☐ No☐	
Plug_____ Alter Casing_____	Recompleted Producing_____	
Waterflood _____ Water Disposal_____	Waterflood _____	
Abandon_____	Water Disposal_____	
Other_____	Abandoned_____	
	Other_____	
	MAP AND BOOK_____ Engineer_____	

RECORDS FILED AND DATE Clerk_____

Summary_____

Log and Core_____

History_____

E-log_____

_____

Directional Survey_____

Other_____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location_____ Notice states_____

_____

_____

_____

_____

Elevation_____ Notice states_____

_____

_____

_____

Production Reports_____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection_____

Data Needed_____

Request Records_____ OGD170____

Correct records_____ OGD165____
(Specify)

EDP_____ (OGD42A-1, 2) ___

CARDS_____

BOND_____

Hold_____ Reason_____

Release____ Date Eligible_____ OGD150____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection_____ Engineer____

FINAL LETTER_____ OG159____

and

File cleared _____ OGD121____

OGD2 (LONG BEACH)

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
APR 2 1990
WOODLAND, CALIFORNIA

History of Oil or Gas Well
UPDATE

Operator QUINTANA PETROLEUM CORPORATION Field -- County San Joaquin
Well MORESCO UNIT "A" #1, Sec. 28, T 3N, R 5E, MD B. & M.
A.P.I. No. 077-20469 Name J. M. Williams (Person submitting report) Title Production Tech. (President, Secretary or Agent)
Date March 28, 1990

Signature J. M. Williams

1050 - 17th Street, Suite 400, Denver, Colorado 80265 (Address) (303)628-9211 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date

SEE ATTACHED DETAIL SHEET

QWO—3

SHEET C
Page No.___
WR90-03

QUINTANA PETROLEUM CORPORATION

REPAIR RECORD

Lease MORESCO UNIT "A" #1 **Well No.**_____ **Field** King Island Gas

Completion Date: 10/5/85 **Type Unit**_____

Company Representative T. Abbott - Consultant **Contractor:** WellTech

Date	P.B.T.D.	Details of Operations, Description and Results
		PURPOSE OF WELL REPAIR: Squeeze existing perfs (4744'-4750' DIL) and reperforate 4724'-4728', 4705'-4707' and 4698'-4700'.
2/13/90		Move in and spot WellTech Rig #245. DC $855
2/14/90	4735'	Day 1. RU, kill well. ND tree. NU BOPE. POOH w/tbg and packer. RU Halliburton Logging Service and make junk basket run to 4740'. Set EZSV at 4735'. SDFN. DC $5999 CTD $6854
2/15/90	4735'	Day 2. TIH with 2 7/8" tubing and stinger assy. Test EZSV to 1000#. Squeeze w/50 sxs cem. 4744'-4750'. Reverse out. POOH w/tbg. RU perforators. Perforate 4724'-4728' with 8 jspf, total 31 holes. SDFN. DC $7272 CTD $14,136
2/16/90	4735'	Day 3. RIH, perforate 4698'-4700' with 8 jspf, 32 holes . RD perforators. PU tubing and Model "R" packer. RIH 21 stds. Shut down for weather. DC $4633 CTD $18,769
2/17/90	4735'	Day 4. RIH with tubing string. Set packer at 4672'. Bottom of buting at 4708'. ND BOP. NU tree. RU and swab. Made 5 runs to 2600'. Well kicked off. RU test separator. Test well. Well flowed 952 MCFD on 18/64" ck. FTP 1060 psi. Dry gas. RD and release rig 1600 hrs 2/17/90. FINAL REPORT. DC $3261 CTD $22,030

2 7/8" TUBING DETAIL

1 -	2 7/8" 6.5# J-55 8Rd EUE mule shoe	31.09'
1 -	2 3/8" EUE 8Rd box and 2 7/8" EUE 8Rd pin crossover	.32'
1 -	5½" x 2 3/8" Model "R" DG (Baker) packer	6.86'
1 -	2 3/8" EUE 8Rd pin x 2 7/8" EUE 8Rd box crossover	.43'
1 -	2 7/8" Model "F" nipple (2.25" ID)	.97'
151 jts	2 7/8" 6.5# J-55 8Rd EUE tubing	4659.18'
	Total string length	4698.85'
	Distance RKB to hanger	+ 11.00'
		4709.85'
	Stroke to set packer	- 1.91'
	Setting depth	4707.94'
	Less mule shoe and packer	- 38.27'
	Top of packer	4671.58'
	Less "F" nipple and crossover	- 1.40'
	Top of "F" nipple	4670.18'

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 690-048

351 (field code)
00 (area code)
10 (new pool code)
10 (old pool code)

PERMIT TO CONDUCT WELL OPERATIONS

James R. Weddle, agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Woodland, California
February 1, 1990

Your proposal to rework well "Moresco et al Unit A" 1,
A.P.I. No. 077-20469, Section 28, T. 3N, R. 5E M.D. B. & M.,
King Island Gas field, Any area, Mokelumne River pool,
San Joaquin County, dated 1/25/90, received 1/26/90 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 5½" casing and maintained in operating condition at all times. (See Manual MO7 and attached sheet.)

2. Wire line operations are conducted through at least a 3M lubricator.

Blanket Bond
RLH/km
cc: Co. Prudential Plaza

Engineer _____

Phone _____

M. G. MEFFERD, State Oil and Gas Supervisor

By Robert A. Reid
Deputy Supervisor
ROBERT A. REID

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (11/88/DWRR/5M)

OG 107 (8/79)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
JAN 29 1990
WOODLAND, CALIFORNIA

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well MORESCO ETAL UNIT "A" #1 (Well designation), API No. 077-20469

Sec. 28, T. 3N, R. 5E, MD B. & M., King Island Gas Field, San Joaquin County.

The present condition of the well is as follows:

1. Total depth 6500'

2. Complete casing record, including plugs and perforations
   8 5/8" 24# J-55 set at 723'.
   5 1/2" 15.5# K-55 set at 4999'.
   2 7/8" 6.5# J-55 set at 4728.22'.
   Perfed and squeezed: 4744'-4760'.
   Reperfed: 4744'-4750'.

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure SITP 1015 psi BHP 2064 psi @4750'; New zone pressure

5. Last produced 10/14/89 (Date) | (Oil, B/D) | 62 BW (Water, B/D) | 50 mcf (Gas, Mcf/D)

   (or)

   Last injected (Date) | (Water, B/D) | (Gas, Mcf/D) | (Surface pressure, psig)

The proposed work is as follows:

Kill well with clean water. Install BOPE. Unset packer (4699'). Reset packer at 4575'. Squeeze perfs. PU bit, RIH and dress plug to 4735'. Test casing and plug then swab test. POOH with tubing. Perforate 4724'-4728'; 4705'-4707' and 4698'-4700' with 3 3/8" gun, 8 jspf, 360° phasing. PU packer and tailpipe assy. RIH and set packer at 4650'. ND BOPD and NU christmas tree. Swab well, test. RD service unit. Return well to production.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 1050-17th St., Suite 400 (Street)

Denver (City) Colorado (State) 80265 (Zip)

Telephone Number (303)628-9211

Quintana Petroleum Corporation (Name of Operator)

By J. M. Williams (Print Name)

J. M. Williams (Signature) 1/25/90 (Date)

C A L I F O R N I A
DIVISION OF OIL AND GAS

TO: James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Dr., Suite 133
Bakersfield, CA 93309

FROM: John C. Sullivan
DEPUTY SUPERVISOR
Division of Oil & Gas
221 W. Court St., Suite 1
Woodland, CA 95695

SUBJECT: ☐ Request for confidential status dated _____, 19___.

☒ Request for extension of confidential status dated 3-7-88.

☒ Subject request is approved.

☐ Subject request is partially approved.

☐ Subject request is denied.

Records approved for confidential status are:

WELL NAME & NUMBER	FIELD OR COUNTY	CONFIDENTIAL RELEASE DATE
28/3N/5E "Moresco et al Unit A" 1	King Island Gas 077-20469	2nd Ext. 9/15/88
REMARKS:		

John C. Sullivan
DEPUTY SUPERVISOR

QUINTANA PETROLEUM CORPORATION

1050 SEVENTEENTH STREET
SUITE 400
DENVER, COLORADO 80265
(303) 628-9211

March 7, 1988

DIVISION OF OIL AND
RECEIVED
MAR 9 1988
WOODLAND, CALIFORNIA

State of California
Division of Oil & Gas
District #6
221 West Court Street, Suit #1
Woodland, California 95695

RE: Moresco etal Unit "A" #1
Section 28, T3N-R5E
San Joaquin County, California

Gentlemen:

In accordance with Public Resources Code Section 3234, Quintana Petroleum Corporation requests that the time period for confidentiality on the subject well be extended six months. We are still analyzing the results of drilling in this area and do not wish the information to be released at this time.

Please advise if you require further information in order to comply with this request.

Very truly yours,

Jeannie Williams
Production Technician

/jw
cc: B. Gerber

Colette
Grant 2nd
6 mos. Ext
9-15-86

Colette
Pull well
record for JCJ

QUINTANA PETROLEUM CORPORATION
1050 SEVENTEENTH STREET
SUITE 400
DENVER COLORADO 80265
(303) 628-9211

...SION OF OIL AND G.
RECEIVED
FEB 8 1988
...WOODLAND, CALIFORNIA

February 4, 1988

State of California
Division of Oil & Gas
District No. 6
221 West Court Street, Suite #1
Woodland, California 95695

Attention: Mr. Rob Hauser

RE: Moresco et al Unit "A" #1
SW SE SE NE Section 28, T3N-R5E
San Joaquin County, California

Dear Rob:

Per our conversation today, it has come to my attention that the elevations submitted on the Notice of Intention to Drill, as well as all subsequent forms, logs, etc., are incorrect. Please note the correct information listed below and change your records accordingly.

Ground Elevation: -7.8'
K.B.: 3.2'

Please call if you require further information.

Very truly yours,

Jeannie Williams
Production Technician

/jw
cc: Quintana - Houston
Standard Oil Production Co.
Tenneco Oil Company
Jim Tasker
Jim Weddle

CALIFORNIA
DIVISION OF OIL AND GAS

To: James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Dr., Suite 133
Bakersfield, CA 93309

From: John C. Sullivan
DEPUTY SUPERVISOR
Division of Oil and Gas
117 W. Main St., Suite 11
Woodland, CA 95695

Subject: ☐ Request for confidential status dated _____, 19__.

XXX ☒ Request for extension of confidential status dated Sept. 15, 19 87.

XXX ☒ Subject request is approved.

☐ Subject request is partially approved.

☐ Subject request is denied.

Records approved for confidential status are:

WELL NAME AND NUMBER	FIELD OR COUNTY	DATE ON WHICH RECORDS WILL BECOME PUBLIC
(077-20469) "Moresco et al Unit A" 1	KING Island Gas 28/3N/5E	1st Ext. 3/15/88

Remarks: _____

John Sullivan
(Signature)

John C. Sullivan
(Name)

DEPUTY SUPERVISOR

QUINTANA PETROLEUM CORPORATION
1050 SEVENTEENTH STREET
SUITE 400
DENVER, COLORADO 80265
(303) 628-9211

DIVISION OF OIL AND GAS
RECEIVED
SEP 17 1987
WOODLAND, CALIFORNIA

September 15, 1987

State of California
Division of Oil & Gas
District No. 6
221 West Court St., Suite #1
Woodland, California 95695

RE: Moresco etal Unit "A" #1
Section 28, T3N-R5E
San Joaquin County, California

Gentlemen:

In accordance with Public Resources Code Section 3234, Quintana Petroleum Corporation respectfully requests that the time period for confidentiality on the subject well be extended six months. We are still analyzing the results of drilling in this area and do not wish the information to be released at this time.

Please advise if you require further information in order to comply with our request.

Very truly yours,

Jeannie Williams
Production Technician

/jw
cc: B.Gerber

Colette
Give First
6 month ext
to 3-15-88
JCS

DIVISION OF OIL AND GAS

CHECK SHEET - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. 11-20769 Sec. _____, T. _____, R. _____, _____ B.&M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	10/25/85
History (Form OG103)	✓
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other Well report	12/12/85
Date final records received	
Electric logs: Arrow Plot	9/24/85
Volan 5"	✓
Mud	✓ Cyberscan 12/2/85
Fac/CNL 2",5"	✓ CBL 2" ✓
DIL/SFL 2",5"	✓ TDT 5" ✓
Sonic 2",5"	✓

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Waterflood	___
Abandoned - Oil	___	Steamflood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	___	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Waterflood Source	___		

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports ✓
10. Casing Record ✓
11. Plugs
12. Surface Inspection
13. Production
14. E Well on Prod. Dir. Sur.

CLERICAL CHECK LIST

1. Location change ___ (F-OGD165)
2. Elevation change ✓ (F-OGD165)
3. Form OGD121
4. Form OG159 (Final Letter)
5. Form OGD150b (Release of Bond)
6. Duplicate logs to archives
7. Notice of Records due (F-OGD170)
8. EDP (F-OGD42A-1, 2)

Mines production

077 20469

CODE EXPIRES - 9/15/87

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED RT 11/19/85

Hold for prod.

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK _____

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (12/82/DWRR/5M)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B.&M.

WORK PERFORMED	STATUS	DATE
Drill_____ Redrill_____ Deepen_____	Producing_____ "E" well Yes☐ No☐	
Plug_____ Alter Casing_____	Recompleted Producing_____	
Waterflood _____ Water Disposal_____	Waterflood _____	
Abandon_____	Water Disposal_____	
Other_____	Abandoned_____	
	Other_____	
	MAP AND BOOK_____ Engineer_____	

RECORDS FILED AND DATE Clerk_____

Summary_____

Log and Core_____

History_____

E-log_____

_____

Directional Survey_____

Other_____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location_____ Notice states_____

_____

_____

_____

_____

Elevation_____ Notice states_____

_____

_____

_____

Production Reports_____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection_____

Data Needed_____

Request Records_____ OGD170____

Correct records_____ OGD165____
(Specify)

EDP_____ (OGD42A-1, 2) ___

CARDS_____

BOND_____

Hold_____ Reason_____

Release____ Date Eligible_____ OGD150____

End premium year _____

Release requested _____ (Check One)

Bond superseded _____

Well abandoned _____

Environmental Inspection_____ Engineer____

FINAL LETTER_____ OG159____
and
File cleared _____ OGD121____

OGD2 (LONG BEACH)

Form OG100 (7/79)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
OCT 28 1985
WOODLAND, CALIFORNIA

API No. 077-20469

WELL SUMMARY REPORT

Operator	Well				
QUINTANA PETROLEUM CORPORATION	MORESCO ETAL UNIT "A" #1				
Field	**County**	**Sec.**	**T.**	**R.**	**B.&M.**
Rio Blanco	San Joaquin	28	3N	5E	M.D.

Location (Give surface location from property or section corner, street center line and/or California coordinates)
1900' North along section line and 350' West at right angles to said line from the SE corner of Section 28 (SW SE SE NE).

Elevation of ground above sea level
~7.8'

Commenced drilling (date)
9/6/85

Completed drilling (date)
9/14/85

Commenced producing (date)
S.I. waiting on pipeline
☐ Flowing ☐ Pumping
☐ Gas lift

Name of producing zone(s)
Mokelumne

Total depth

(1st hole)	(2nd)	(3rd)
6500'		

Present effective depth
4999'

Junk

Depth measurements taken from top of:
☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing
Which is 9' feet above ground

GEOLOGICAL MARKERS	DEPTH
Domengine	3817'
Capay	4603'
Mokelumne	4696'
Starkey	6303'

Formation and age at total depth
Cretaceous Starkey

	Clean Oil (bbl per day)	Gravity Clean Oil	Percent Water including emulsion	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production			-0-	8.2 MMCFPD	1669 FTP	
Production After 30 days	Well shut in - waiting on pipeline connection.					

CASING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New or Second Hand	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)
8 5/8"	Surface	723'	24#	8RD ST&C J-55	New	12¼"	372 sxs	
5 1/2"	Surface	4999'	15.5#	8RD LT&C K-55	New	7 7/8"	155 sxs	

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforation and method.)
4744'-4760' with 4" casing gun with 8 jspf.

Was the well directionally drilled? If yes, show coordinates of total depth
☐ Yes ☒ No

Electrical log depths
CET/GR & CBL/VDL/CNL 3831'-4856'; TDT 3837'-4861'; DIL-Sonic 723'-6500'; LDT/CNL/GR 3100'-6500' Dipmeter 3500'-6500'

Other surveys

In compliance with Sec. 3215, Division 3 of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name	Title	
E. Scott Kimbrough	District Operations Engineer	
Address	**City**	**Zip Code**
818 - 17th Street, Suite 610	Denver, Colorado	80202
Telephone Number	**Signature**	**Date**
(303)628-9211	E. Scott Kimbrough	10/25/85

SUBMIT IN DUPLICATE

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED

OCT 28 1985

WOODLAND, CALIFORNIA

History of Oil or Gas Well

Operator QUINTANA PETROLEUM CORPORATION Field or County San Joaquin County
Well MORESCO ETAL UNIT "A" #1, Sec. 28, T 3N, R 5E, M.D.B. & M.
A.P.I. No. 04-077-20469 Name John W. Wessels (Person submitting report) Title District Opns. Mgr. (President, Secretary or Agent)
Date October 25, 19 85

Signature John W. Wessels

818 - 17th Street, Suite 610, Denver, Colorado 80202 (Address) (303)628-9211 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date

PLEASE SEE ATTACHED DETAIL SHEETS

AFE #55621

SHEET A

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

PAGE NO. 1

LEASE MORESCO ETAL UNIT "A" WELL NO. #1
FIELD
LOCATION 1900'FNL & 350' FEL
SW SE SE NE Section 28, T3N-R5E
MDB&M
San Joaquin County, California
PERMIT NO. API NO. -077-20469
T.D. 6500' T.V.D. 6500'
DEVIATION (B.H.L.) Not directionally drilled.
COMPANY ENGINEER O. Duncan - Consultant

SPUD DATE 9/6/85 COMP. DATE 10/5/85
CONTRACTOR Atlantic Drilling. RIG NO. #7
TYPE UNIT
DRILL PIPE DESCRIPTION 4" FH

ELEVATIONS: GROUND 7.8'
CASING HEAD 7.8'
TUBING HEAD 8.4'
ROTARY DRIVE BUSHING 18.8'

APPROVED [signature] 10/20/85

DATE	In DEPTH	BIT RECORD: BIT NO.	SIZE	MAKE	TYPE	JET SIZE	DEPTH OUT	FEET	HOURS	COND. T/B/G/	FT./HR.	DEPTH & DEVIATION: VERTICAL ⊘ DIRECTIONAL ⊙
1985												
9/7	40	1A	12¼	SEC	S3J	3-16	725	685	7		98	½° @263'
												3/4° @450'
9/8	685	1	7 7/8	RTC	HP11	3-10	3116'	2391	18½		129	1° @1002'
												½° @1498', 1995'
												¼° @2722', 3116'
9/9	3116	2	7 7/8	SEC	S33F	"	4140'	1025	11 3/4		87.2	½° @4110'
9/10	4140	3	7 7/8	STC	FDS	3-10	5142'	1002	15¼		65.7	3/4° @5142'
9/11	5142	4	7 7/8	RTC	HP12J	2-11	6230'	1088	21½		50.6	3/4° @6230'
						1-10						
9/12	6230	5	7 7/8	RTC	Y11J	"	6500'	270	8½		31.7	1° @6500'

QUINTANA PETROLEUM CORPORATION

WELL RECORD

SHEET C

PAGE NO 1

AFE #55621

LEASE MORESCO ETAL UNIT "A" WELL NO. #1 FIELD

CASING & TUBING RECORD

SIZE	WEIGHT	THREAD	GRADE	DEPTH	REMARKS
8 5/8	24#	8RD ST&C	J-55	723'	Cem w/372 sxs "G"
5 1/2	15.5#	8RD LT&C	K-55	4999'	Cem w/155 sxs "G"

PERFORATING RECORD

DATE	INTERVAL	F.T.D.	REASON	PRESENT CONDITION
10/4	4744'-4760'		Production	Open

INITIAL PRODUCTION

DATE	INTERVAL	NET OIL	CUT	GRAV.	C.P.	T.P.	CHOKE	MCF	GOR	REMARKS
10/23	4744'-4760'	---	-0-	--		1669 FTP	25/64"	8.2 MMCF	N/A	

WELL HEAD ASSEMBLY

TYPE

CASING HEAD: 11" x 3M# x 8 5/8" SOW w/2" screwed outlets w/bull plug & XXH nipple, 2" ball valve

CASING HANGER: 11" x 5½" BSJ slips

CASING SPOOL:

TUBING HEAD: 11" x 3M# x 7 1/16" x 3M# DWC w/2-2" studded outlets w/2 1/16" x 3M# WIC Gate Valve

TUBING HANGER: 7 1/16" x 2 3/8" DWC Thd 2 3/8" EUE

TUBING HEAD TOP:

MASTER VALVES:

CHRISTMAS TREE TOP CONN.:

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

PAGE NO. 1

AFE #55621

LEASE MORESCO etal Unit "A" WELL NO. 1 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
		Location: Section 28, T3N-R5E San Joaquin County, California
9/6/85		Location complete this afternoon. Will move in Atlantic Rig #7 then.
9/7/85	725'	Day 1. Drld 685', cond. trip, sd, cl, and gravel, MW 8.8, vis 55. Surveys: ¼° @ 263', 3/4° @ 450'. MIRU Atlantic Rig #7. Spud at 2100 hrs 9/6/85. Drld to 725', now making conditioning trip to run surf casing. DC: $17,784 CTD: $17,784
9/8/85	1498'	Day 2. Drld 773', drlg, sd and clay, MW 9.3, vis 39. Surveys: 1° @ 1002', ½° @ 1498'. Fin cond trip. Circ hole. POOH. RU and run 18 jts 24# casing. Set at 723'. Cmtd w/BJ Titan Cementers w/222 sx class "G" + 8% gel + 3% $CaCl_2$. Tailed in w/150 sx class "G" + 3% $CaCl_2$. Total slurry volume 578 cu ft (100% excess). PD at 10:24 a.m. 9/7/85 w/1000 psi. Released press. Float valve held OK. Had 200 cu ft clean cmt returns (17% excess). WOC 4 hrs. Install 10" casinghead and 10" BOP assembly. Tested csg and BOP assembly, choke manifold, stand pipe, kelly cock and valves to 1500 psi. Witnessed and approved by D.O.G. Cut off csg, weld on head and test. NU BOPE and test. TIH and drld cmt and plugs. NDA. DC: $20,657 CTD: $38,441
9/9/85	3768'	Day 3. Drld 2270', drlg, sd and clay, MW 9.6, vis 38, WL 14.2. Surveys: ½° @ 1995', ¼° @ 2772', ¼° @ 3116'. Drld to 3116', TFNB, NDA. DC: $8046 CTD: $46,487
9/10/85	5069'	Day 4. Drld 1301', drlg, sd and clay, MW 9.4, vis 39, WL 6.4. Survey: ½° @ 4110'. Drld to 4140', TFNB, NDA.
9/11/85	5858'	Day 5. Drld 789', drlg, sd, clay and sh, MW 9.9, vis 41, WL 6.4. Survey: 3/4° @ 5142'. Drld to 5142'. TFNB. Wash and ream out of gauge hole 4841'-5152'. Drld to 5754'. Made ST to 5142'. NDA. DC: $16,125 CTD: $73,357
9/12/85	6500'	Day 6. Drld 642', ST, sd, clay and sh, MW 10.2, vis 40, WL 7.2. Survey: 3/4° @ 6230'. Drld to 6230'. TFNB. Drld to 6500'. Circ and cond, ST. DC: $8634 CTD: $81,991
9/13/85	TD 6500'	Day 7. WO Schlumberger tools, MW 10.2, vis 40, WL 7.2. Survey: 1° @ 6500'. Fin ST. POOH for logs. RU Schlumberger. Ran DIL BHC Sonic from TD to BSC. (LTD 6480' - DTD 6500') Ran GR-LDT-CNL from TD-3500'. Attempted to run Dipmeter. Tool failed. Now WO Schlumberger. DC: $9719 CTD: $91,710
9/14/85	TD 6500'	Day 8. WOC. Fin WO Schlumberger. Ran Dipmeter. Made cond trip. LD DP and DC. RU and ran 124 jts 5½" 15.5# K-55 8rd LT&C R-3 csg and set at 5000'. Circ and cond mud. RU BJ. Cmtd csg w/155 sx class "G" cmt w/10% salt mixed to 15.9 ppg (yield 1.16 cu ft/sk, total slurry volume 179 cu ft). Full returns while cmtg. PD at 2:24 a.m. 9/14/85 w/1500 psi. Rlsd press and floats held OK. Set slips in full tension. Now WOC. DC: $69,571 CTD: $161,281
9/15/85	TS 6500'	Day 9. Fin WOC. Cut off csg and installed tbg head. Tstd to 3000 psig. Installed flange w/valve on top of spool. Rig released at 1200 hrs 9/14/85. Now waiting on completion rig. DC: $9244 CTD: $110,525
10/4/85	4955' (FC)	MI & RU Schlumberger mast truck. Ran CET/GR and CBL/VDL/CNL 4856-3831 with 0 and 1500 psi. Ran TDT 4861'-3837'. RD and MO Schlumberger. Logger TD 4864'. SDFN at 2400 hrs. 10/3/85. DC $6779 CTD $177,304

LEASE MORESCO ETAL UNIT "A" WELL NO. #1 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
10/5/85	4908'	MI & RU Welltech Rig #246. NU BOPE and test to 1500 psi. Made bit and scraper run to 4908'. RO w/10 ppg brine, POOH, pressure test lubricator to 500 psi. RU McCullough and perforate Mokelumne 4744'-4760' DIL-TDT with 4" casing gun with 8 jspf. Second perf gun stuck. Worked free in one hour. RD McCullough. RIH w/Model "R" DG pkr, mule shoe, "F" nipple and set pkr at 4688'. M.S. at 4711'. NU and test tree to 1500 psi. DC $13,049 CTD $190,353.
10/6/85	4908'	RIH w/swb and ta fluid at 721'. Pulled from 1700' and well cam in. Recovered 22 BF (all load). Shut well in. Removed swb equipment and hook up flow line to pit. ISITP 1700 psi. FSITP 1870 psi (25 min). Opened well and flowed as follows: Time / PSI / Rate / Choke Size 1155 / 1700 / 595 / 8/64" 1215 / 1600 / 561 / " 1225 / 1650 / 578 / " 1230 / 1800 / 680 / " Not making any fluid. Shut well in and move rig off. RU Bruce Services testing equipment and McInnally Slickline. RIH w/2-48 hr (3000 psi) clocks. On bottom with clocks at 00300 hrs 10/6/85. Flowed well through production equipment as follows: Time / PSI / Rate / Choke Size 0330 / 1865 / 535 / 7/64" 0345 / 1865 / 535 / " 0400 / 1860 / 535 / " 0415 / 1860 / 535 / " 0430 / 1860 / 535 / " 0445 / 1860 / 521 / " 0500 / 1860 / 535 / " 0515 / 1860 / 534 / " Installed 8/64" choke 0530 / 1850 / 858 / 8/64" 0545 / 1840 / 856 / " 0600 / 1835 / 858 / " 0615 / 1825 / 858 / " 0630 / 1825 / 858 / " 0645 / 1825 / 858 / " 0700 / 1825 / 856 / " 0715 / 1825 / 856 / " Changed choke to 9/64" 0730 / 1800 / 1191 / 9/64 0745 / 1800 / 1194 / " 0800 / 1800 / 1189 / " 0815 / 1800 / 1189 / " 0830 / 1800 / 1189 / " DC $31,239 CTD $221,592
10/7/85	4908'	Finish running 4-pt test. RD and MO test equipment. Time / PSI / Rate / Choke Size 0845 / 1800 / 1189 / 9/64 0900 / 1800 / 1194 / " 0915 / 1800 / 1191 / " Changed choke to 10/64" 0930 / 1790 / 1557 / " 0945 / 1785 / 1533 / " 1000 / 1780 / 1533 / " 1015 / 1775 / 1533 / " 1030 / 1775 / 1533 / " 1045 / 1775 / 1533 / " 1100 / 1775 / 1535 / " 1115 / 1775 / 1534 / " 1130 / 1775 / 1534 / " Shut in at 11:30 a.m. 10/6/85. ISITP 1800 psi at 1132 hrs.:

LEASE MORESCO ETAL UNIT "A" WELL NO. #1 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
10/7/85 cont'd		Time SIP 1135 1870 1140 1820 1145 1830 1200 1870 0100 1870 0200 1870 2400 1870 Pulled bombs at 2401 hrs 10/7/85. 12-hr. buildup. FINAL REPORT. DC $2650 CTD $224,242
		8 5/8" CASING DETAIL
9/8/85		1 - 8 5/8" B&W 8RD ST&C guide shoe ..... 1.15' 1 jt 8 5/8" 24# J-55 8RD ST&C R-3 casing ..... 40.36' 1 - 8 5/8" B&W insert float valve ..... 0.00' 17 jts 8 5/8" 24# J-55 8RD ST&C R-3 casing ..... 685.43' Total casing run ..... 726.94' Casing cut off ..... 14.88' Casing in hole ..... 712.06' RKB to casinghead ..... 11.00' Casing set at ..... 723.06'
9/15/85		**5 1/2" CASING DETAIL**
		1 - 5½" B&W guide shoe ..... .88' 1 jt 5½" 15.5# K-55 LT&C 8RD R-3 casing ..... 41.24' 1 - 5½" B&W diff. fill float collar (FC @4957.88')..2.00' 123 jts 5½" 15.5# K-55 LT&C 8RD R-3 casing ..... 4962.29' Total casing run ..... 5006.41' Casing cut off ..... 18.10' Casing in hole ..... 4988.31' Distance RKB to casinghead ..... 11.00' Casing set at ..... 4999.31' Turbolizers set at 4985', 4830', 4787', 4708', 4666', 4583', 4498', 4421' and 4339'.
		2 7/8" TUBING DETAIL
		1 - 2 7/8" 6.5# J-55 EUE 8RD mule shoe ..... 31.00' 1 - 2 3/8" EUE 8RD box x 2 7/8" EUE 8RD Pin Xover..... .32' 1 - 2 7/8" x 5½" Baker Model R-3 D.G. Retrievable pkr. 6.89' 1 - 2 7/8" EUE 8RD box x 2 7/8" EUE 8RD pin Xover..... .43' 1 - 2.25 Model "F" S.N. w/2 7/8" EUE 8RD box x pin ... .97' 151 jts 2 7/8" 6.5# J-55 EUE tubing ..... 4660.56' 1 - 2 7/8" 6.5# J-55 EUE 8RD Slick Joint ..... 31.31' Total tubing and equipment in hole ..... 4731.48' Distance RKB to hanger ..... + 11.00' Effective setting depth ..... 4742.48' Stroke to set 10,000# weight ..... - 1.40' Mule shoe ..... - 31.00' Bottom of packer set at ..... 4710.08'

CALIFORNIA
DIVISION OF OIL AND GAS

To: James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

From: John C. Sullivan
DEPUTY SUPERVISOR
Division of Oil and Gas
117 W. Main St., Suite 11
Woodland, CA 95695

Subject: ☐ Request for confidential status dated Oct. 18, 1985, 19___.

☐ Request for extension of confidential status dated _____, 19___.

☒ Subject request is approved.

☐ Subject request is partially approved.

☐ Subject request is denied.

Records approved for confidential status are:

WELL NAME AND NUMBER	FIELD OR COUNTY	DATE ON WHICH RECORDS WILL BECOME PUBLIC
"Moresco et al Unit A" 1 (077-20469)	28/3N/5E San Joaquin County	Two years from the date of removal of drilling equipment.

Remarks: _____

John C. Sullivan
(Signature)

John C. Sullivan
(Name)

DEPUTY SUPERVISOR
(Title)

Date 10/21/85

OGD181

QUINTANA PETROLEUM CORPORATION

818 17TH STREET
SUITE 610
DENVER, COLORADO 80202
(303) 628-9211

DIVISION OF OIL AND GAS
RECEIVED
OCT 21 1985
WOODLAND, CALIFORNIA

October 18, 1985

Division of Oil & Gas
District 6 Office
117 W. Main Street
Suite 11
Woodland, California 95695

RE: Moresco etal Unit "A" #1
Section 28, T3N-R5E, M.D.B.& M.
San Joaquin County, California

Gentlemen:

We request that all information on the subject well be maintained as "confidential". Thank you.

Very truly yours,

Jeannie Williams
Production Technician

/jw

Rose Explor Well
Grant Co'td
States

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT OF CORRECTION OR CANCELLATION

Woodland, California

September 20, 1985

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

In accordance with information on file in this office

the following change pertaining to your well "Moresco et al Unit A" 1, (Well designation)
-- field, San Joaquin County,
Sec. 28, T. 3N, R. 5E, M.D. B. & M., is being made in our records:

[X] The corrected location is 1900' North along section line and 350' West at right angles to said line from the SE corner of Section 28.

[ ] The corrected elevation is _____

[ ] Report No. _____, dated _____, has been corrected as follows: _____

[ ] Your notice to _____ (Drill, abandon, etc.) dated _____,
and our report No. P_____, issued in answer thereto, are hereby cancelled inasmuch as the work will not be done. If you have a drilling bond on file covering this notice it will be returned. No request for such return is necessary.

[ ] Other: _____

cc: John W. Wessels

M. G. Mefferd
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor

John C. Sullivan

OG165 (9/84/DWRR/3M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

SUPPLEMENTARY NOTICE

MEMO

FOR DIVISION USE ONLY		
BOND	FORMS	
	114	121

DIVISION OF OIL AND GAS

Woodland Calif.

A notice to you dated August 6, 1985, stating the intention to drill (Drill, rework, abandon), Well No. Moresco etal Unit "A"#1 API No. 077-20469, Sec. 28, T. 3N, R. 5E, M.D.B. & M., --- Field, San Joaquin County, should be amended because of changed conditions.

The present condition of the well is as follows:

Total depth

Complete casing record including plugs and perforations:

Notice of Intention to Drill New Well stated location to be:

2900' North along section line & 350' West
at right angles to said line form the SE corner
of Section 28

Location should read: (corrected survey plat attached)

1900' North along section line and 350' West
at right angles to said line from the SE corner
of Section 28.

We now propose

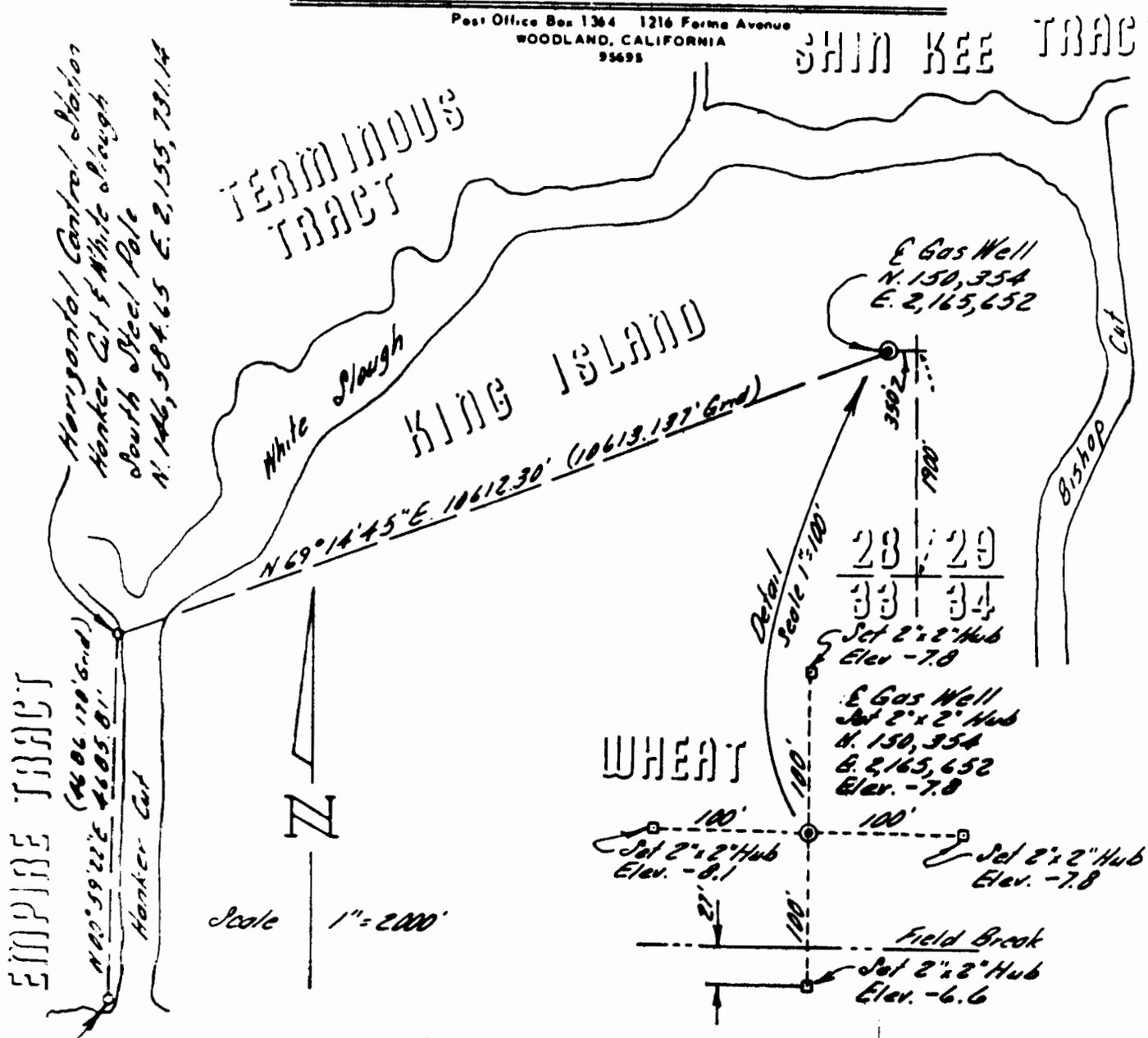
It is understood that if changes in this plan become necessary we are to notify you immediately.

Address 818-17th St., Suite 610 (Street)
Denver, Colorado 80202 (City) (State) (Zip)
Telephone Number (303)628-9211

QUINTANA PETROLEUM CORPORATION (Name of Operator)
By John W. Wessels (Name) 9/12/85 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG123 (4-75-GSR1-5M)

YOLO ENGINEERS & SURVEYORS, INC.
WOODLAND PH. 662-4346 • DAVIS PH. 753-2515 • WEST SACTO PH. 371-7076
Post Office Box 1364 1216 Forma Avenue
WOODLAND, CALIFORNIA
95695



GAS WELL SITE
Moresco etal Unit "A" No. 1
for
QUINTANA PETROLEUM
on
King Island
Projected T. 3N. R. 5E.
M.D.B.& M.
San Joaquin County, California
June 5, 1985
Revised 9-9-85

NOTE:
Coordinates Based on California State Cordinates System, Zone II

RCE # 16,698

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT OF CORRECTION OR CANCELLATION

Woodland, California

September 13, 1985

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

In accordance with information on file in this office

the following change pertaining to your well "Moresco et al Unit A" 1,
(Well designation)

-- field, San Joaquin County,

Sec. 28, T. 3N, R. 5E, M.D. B. & M., is being made in our records:

☐ The corrected location is

☐ The corrected elevation is

☐ Report No. , dated , has been corrected as follows:

☐ Your notice to dated ,
(Drill, abandon, etc.)
and our report No. P , issued in answer thereto, are hereby cancelled inasmuch as the work will not be done. If you have a drilling bond on file covering this notice it will be returned. No request for such return is necessary.

☒ Other: T Report No. 685-396 should be corrected to T No. 685-386.

cc: John W. Wessels

M. G. Mefferd
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

OG165 (9/84/DWRR/3M)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 685-386

DIVISION OF OIL AND GAS

Report on Operations

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Woodland, Calif.
September 11, 1985

Your operations at well "Moresco et al Unit A" 1, API No. 077-20469,
Sec 28, T 3N, R 5E, M.D. B.& M. --, Field, in San Joaquin County,
were witnessed on 9/7/85. M. Cummings, representative of
the supervisor, was present from 2000 to 2130. There were also present
O. Duncan, Company Representative and R. Langley Drilling Foreman
Present condition of well: 8 5/8" cem. 723'. TD 723'. (standing cemented)

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION

The blowout prevention equipment and its installation on the 8 5/8" casing are approved.

MC:cm

NOTE: Deficiencies noted and to be corrected:

1. Bleed line not staked down.

cc: John W. Wessels

M. G. MEFFERD
State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

OG109(12-80-15M)

9/6/85
ATL 7

DIVISION OF OIL AND GAS

BLOWOUT PREVENTION EQUIPMENT MEMO

T _____

Operator QUINTANA PET. CORP. Well "MORESCO ET AL UNIT N" 1 Field — County SAN JOAQUIN

VISITS:	Date	Engineer	Time	Operator's Rep.	Title
1st	9/7/85	M. Cummings	2000 to 2130	D. DUNCAN	CO REP
2nd			to	R. LANGLEY	DF

Casing record of well: 8 5/8" cem 723'. TD 723. (Standing CEMENTED)

OPERATION: Testing ~~Inspecting~~) the blowout prevention equipment and installation.
DECISION: The blowout prevention equipment and its installation on the 8 5/8 "casing are approved.

REQUIRED BOPE CLASS: III B 2M

Proposed Well Opns: Drilling MPSP: _____ psi
Hole size: _____ " fr. _____ ' to _____ ' , _____ " to _____ ' & _____ " to _____ '

CASING RECORD (BOPE ANCHOR STRING ONLY)					Cement Details	Top of Cement	
Size	Weight(s)	Grade(s)	Shoe at	CP at		Casing	Annulus
8 5/8	24	J55	723		222 sx 8% Gel 3% CA 150 sx 3% CA		RETURNS

BOP STACK

API Symb.	Ram Sz.	Mfr.	Model or Type	Size (in.)	Press. Rtg.	Date Last Overhaul	a Gal. to Close	b Rec. Time (Min.)	a/b Calc. GPM Output
A		Hydril	Bag						
RD		Shaffer	Pipe						
RD		✓	Blind						

TEST DATA

psi Drop to Close	Secs. to Close	Test Date	Test Press.
		9/6	1200
		↘	1500
		↘	DF

ACTUATING SYSTEM

Accum. Unit(s) Wkg. Press. 1500 psi
Total Rated Pump Output _____ gpm
Distance From Well Bore 60 ft.

	Mfr.	Accum. Cap.	Precharge
1	Koomey	60 gal.	750 psi
2		gal.	psi

CONTROL STATIONS	Elec.	Hyd.
✓ Manif. at accum. unit		✓
✓ Remote at Drlr's. stn.	✓	
Other:		

EMERG. BACKUP SYST.	No:	Type:	Press.	Wkg. Fl.
✓ N2 Cyl			1 2000	gal.
Other:			2 ✓	gal.
			3 ✓	gal.
			4	gal.
			5	gal.
			6	gal.

AUXILIARY EQUIPMENT

		No.	Sz. (in.)	Rated Press.	Connections: Weld	Flan.	Thrd.
✓	Fill-Up Line						
✓	Kill Line						
✓	Control Valve(s)						
✓	Check Valve(s)						
✓	Auxil. Pump Connec.						
✓	Choke Line						
✓	Control Valve(s)						
✓	Pressure Gauge						
✓	Adjustable Choke(s)						
✓	Bleed Line						
✓	Upper Kelly Cock						
	Lower Kelly Cock						
✓	Standpipe Valve						
✓	Standpipe Pressure Ga.						
✓	Pipe Safety Valve						
✓	Internal Preventer						

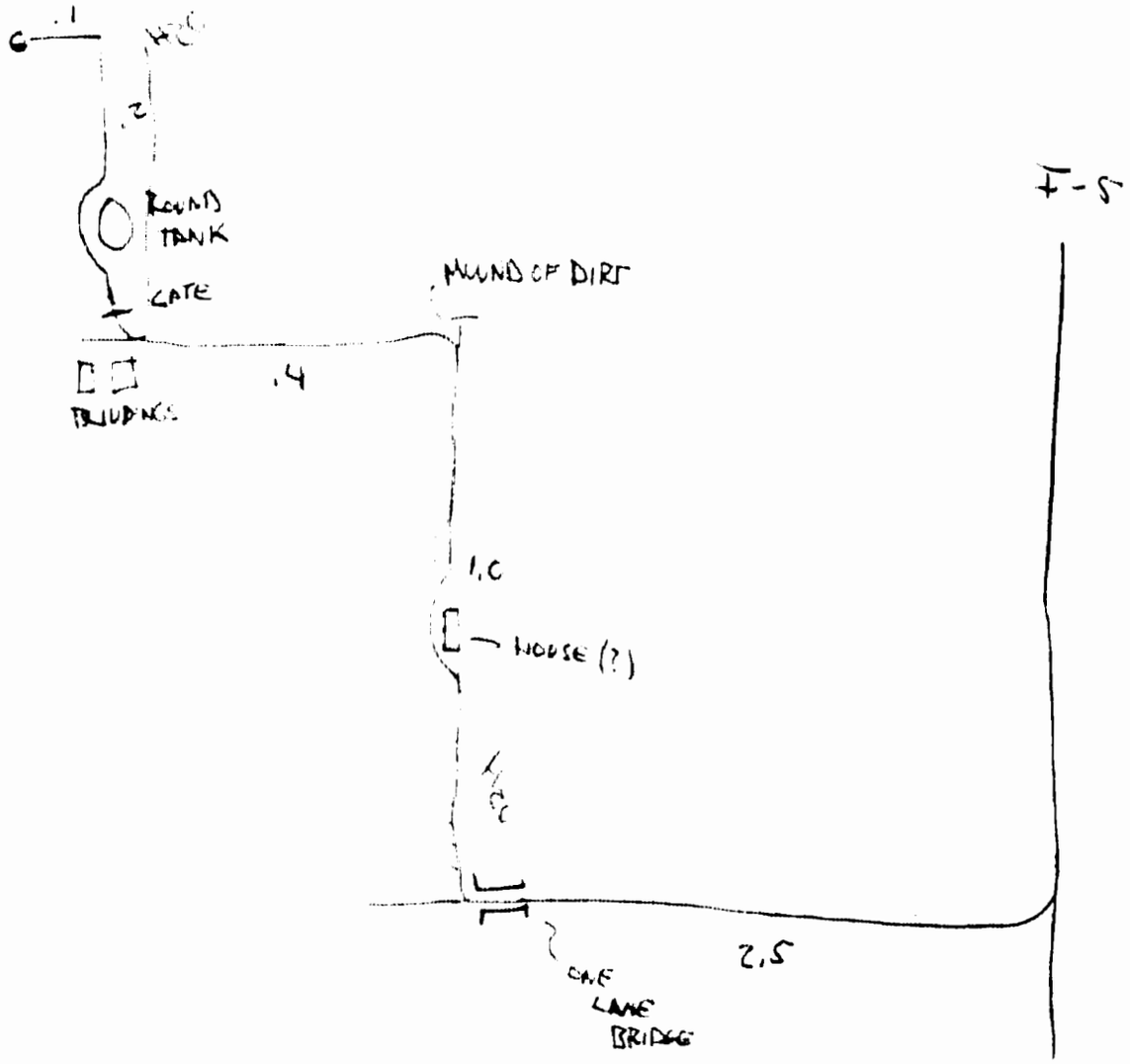
HOLE FLUID MONITORING EQUIPMENT	Alarm Aud.	Alarm Vis.	Class
✓ Calibrated Mud Pit	✓	✓	A
✓ Pit Level Indicator	✓	✓	B
✓ Pump Stroke Counter	✓		
Pit Level Recorder			
Flow Sensor			C
Mud Totalizer			
Calibrated Trip Tank			
Other:			

REMARKS:

c) BLEED LINE NOT STAKED DOWN

Hole Fluid Type	Weight	Storage Pits

OGD9 (3/83/DWRR/3M)



.1
.2
ROUND TANK
GATE
BUILDINGS
.4
MOUND OF DIRT
1.0
HOUSE (?)
ONE LANE BRIDGE
2.5
F-5

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 685-417

REPORT ON PROPOSED OPERATIONS

WELL CLASSIFICATION:
EXPLORATORY, NEW FIELD

-- (field code)
-- (area code)
-- (new pool code)
-- (old pool code)

James R. Weddle
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Woodland, California
August 6, 1985

Your proposal to drill well "Moresco et al Unit A" 1,
A.P.I No. 077-20469, Section 28, T. 3N, R. 5E, M.D. B. & M.,
-- field, -- area, -- pool,
San Joaquin County, dated 7/31/85, received 8/2/85 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8 5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 5 1/2" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8 5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 3 M requirements is installed on the 5 1/2" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The division is furnished copies of any draw down or back pressure tests performed. In addition the division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8 5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.

NOTE: 1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 400'.
2. The actual surface location of this well must be at least 100 feet from the outer boundary of the parcel(s) of land on which the well is situated.

M. G. MEFFERD, State Oil and Gas Supervisor

By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this report and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (11/82/0)WPP/5M)

3. The producing interval of this well shall be not less than 75 feet from the lease line. It will be necessary for Quintana Petroleum Corporation to be able to prove that the location of the wellbore, at the producing interval, is greater than 75 feet from the lease line.

Blanket Bond

RLH:jb

cc: Company

Form OG105 (8/80)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS
Notice of Intention to Drill New Well

DIVISION OF OIL AND GAS
RECEIVED
AUG 2 1985
WOODLAND, CALIFORNIA

Explor. N.F.

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS ____	NEG. DEC. ☐ S.C.H. NO. ____	E.I.R. ☐ S.C.H. NO. ____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☒
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
6 10	8-10-85 RF	✓ ✓	B/B	✓	✓

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well MORESCO ETAL UNIT "A" NO. 1, API No. 077-20469 (Assigned by Division),

Sec. 28, T. 3N, R. 5E, M.D.B. & M., --- Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 572.10± acres, is as follows: (Attach map or plat to scale)

(see attached legal description)

Do mineral and surface leases coincide? Yes X No ____. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 2900 feet North (Direction) along section / ~~property~~ (Cross out one) line and 350 feet West (Direction)

at right angles to said line from the Southeast corner of section / ~~property~~ (Cross out one) 28 or

SW SE SE NE Section 28

Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) at total depth: ____ feet (Direction) and ____ feet (Direction)

Elevation of ground above sea level - 7.8 feet. * See letter of 2/4/88 RAR

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table, or Kelly Bushing) that is +10' +3.2' feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
		SEE ATTACHED DRILLING PROGNOSIS				

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Cretaceous Mokelumne (Name, depth, and expected pressure) Estimated total depth 6500'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
QUINTANA PETROLEUM CORPORATION	CORPORATION	
Address	**City**	**Zip Code**
818 - 17th St., Suite 610	Denver, Colorado	80202
Telephone Number / **Name of Person Filing Notice**	**Signature**	**Date**
(303)628-9211 / John W. Wessels	John W. Wessels	7/31/85

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: San Joaquin County Planning Dept.

Lead Agency Contact Person: Tom Walker

Address: 1810 East Hazelton

Stockton, California 95205

Phone: (209) 944-3722

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks:

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

EXHIBIT "A"

That certain real property situated in the County of San Joaquin, State of California, described as follows:

Parcel One: Commencing at a point near the West end of the highway bridge, crossing Bishop Cut, said point being marked by a railroad spike, stamped R. E. 2909, driven into the pavement of the G. A. Atherton Road No. 550, said point of beginning being South 88° 23' 30" West 14,048.79 feet, more or less, from the Southeast corner of the Section 36, Township 3 North, Range 5 East, Mount Diablo Base and Meridian; thence running South 00° 17' East 4.65 feet to a point in the center line of the 90 foot right of way of the G. A. Atherton Road No. 550, as described in the Deed recorded in Vol. 199 of Official Records, page 123, San Joaquin County Records, thence along the center line of said 90 foot road right of way, South 89° 56' 35" West a distance of 7761.32 feet to a point on the prolongation of the center line of the present drainage canal; thence running along the prolonged center line of said drainage canal, North 00° 43-1/2' West 5424.05 feet to the point of beginning; said point of beginning being the point of intersection of three present drainage canals; thence running along the center line of one of the present drainage canals, North 89° 15' East 6153.62 feet to the point of intersection with the center line of a drainage canal, running in a Northerly direction; thence running along the prolonged center line of the said Northerly drainage canal, North 00° 38-1/2' West 4065.38 feet to a point on the crown of the levee, said point being hereinafter referred to as point "S"; thence running along the crown of the levee the following courses and distances:

South 77° 04' West 312.30 feet; South 85° 54' West 468.23 feet; South 73° 40' West 567.52 feet; North 88° 06' West 156.62 feet; North 76° 52' West 771.60 feet; South 87° 27' West 251.77 feet; South 69° 55' West 287.60 feet; South 35° 56' West 739.40 feet; South 49° 24' West 102.55 feet; South 70° 34' West 140.35 feet; South 83° 23' West 1942.30 feet; South 50° 06' West 79.33 feet; South 22° 40' West 653.21 feet; South 42° 57' West 1207.66 feet; South 39° 25' West 798.28 feet; South 53° 11' West 199.75 feet to a point hereinafter referred to as Point "R", lying on the Northwesterly prolongation of the center line of the present drainage canal; thence running along the prolongated center line of said drainage canal, South 53° 45' East a distance of 1257.06 feet to the point of beginning.

Parcel Two: BEGINNING at the aforementioned Point "S", thence running along the Northerly boundary of Parcel One to Point "R"; thence running along the prolongation of the center line of the present drainage canal, North 53° 45' West 23 feet, more or less, to a point on the outer toe of the levee; thence running along the outer toe of the levee in a generally Northeasterly direction, a distance of approximately 8680.00 feet to a point on the Northerly prolongation of the center line of the present drainage canal; thence running along the prolongation of the center line of said drainage canal, South 00° 38-1/2' East 15.00 feet, more or less, to the point of beginning and containing 4.00 acres, more or less, said Parcel Two being a strip of land with an average width of approximately 20.00 feet and lying between traverse on the crown of the levee and the toe of the levee.

Parcel Three: Commencing at the aforementioned Point "S"; thence running along the Northerly prolongation of the center line of the present drainage ditch, North 00° 38-1/2' West 15.00 feet, more or less, to the point of beginning said point of beginning being on the outer toe of the levee, thence running along the outer toe of the levee in a Southwesterly direction, a distance of approximately 8680.00 feet to a point on the Northwesterly prolongation of the center line of the present drainage canal; thence running along the prolongation of the center line of said drainage canal, North 53° 45' West 360.00 feet, more or less, to a point on the center line of White Slough, thence running along the center line of White Slough in a generally Northeasterly direction to a point on the Northerly prolongation of the center line of the present drainage canal; thence running along the Northerly prolongation of the center line of the present drainage canal, South 00° 38-1/2' East 70.00 feet, more or less, to the point of beginning, said Parcel Three being a strip of land lying between the outer toe of a portion of the levee of King Island and the center line of White Slough.

EXHIBIT "A"

That certain real property situated in the County of San Joaquin, State of California, described as follows:

Parcel One: Commencing at a point near the West end of the highway bridge, crossing Bishop Cut, said point being marked by a railroad spike, stamped R. E. 2909, driven into the pavement of the G. A. Atherton Road No. 550, said point of beginning being South 88° 23' 30" West 14,048.79 feet, more or less, from the Southeast corner of the Section 36, Township 3 North, Range 5 East, Mount Diablo Base and Meridian; thence running South 00° 17' East 4.65 feet to a point in the center line of the 90 foot right of way of the G. A. Atherton Road No. 550, as described in the Deed recorded in Vol. 199 of Official Records, page 123, San Joaquin County Records, thence along the center line of said 90 foot road right of way, South 89° 56' 35" West a distance of 7761.32 feet to a point on the prolongation of the center line of the present drainage canal; thence running along the prolonged center line of said drainage canal, North 00° 43-1/2' West 5424.05 feet to the point of beginning; said point of beginning being the point of intersection of three present drainage canals; thence running along the center line of one of the present drainage canals, North 89° 15' East 6153.62 feet to the point of intersection with the center line of a drainage canal, running in a Northerly direction; thence running along the prolonged center line of the said Northerly drainage canal, North 00° 38-1/2' West 4065.38 feet to a point on the crown of the levee, said point being hereinafter referred to as point "S"; thence running along the crown of the levee the following courses and distances:

South 77° 04' West 312.30 feet; South 85° 54' West 468.23 feet; South 73° 40' West 567.52 feet; North 88° 06' West 156.62 feet; North 76° 52' West 771.60 feet; South 87° 27' West 251.77 feet; South 69° 55' West 287.60 feet; South 35° 56' West 739.40 feet; South 49° 24' West 102.55 feet; South 70° 34' West 140.35 feet; South 83° 23' West 1942.30 feet; South 50° 06' West 79.33 feet; South 22° 40' West 653.21 feet; South 42° 57' West 1207.66 feet; South 39° 25' West 798.28 feet; South 53° 11' West 199.75 feet to a point hereinafter referred to as Point "R", lying on the Northwesterly prolongation of the center line of the present drainage canal; thence running along the prolongated center line of said drainage canal, South 53° 45' East a distance of 1257.06 feet to the point of beginning.

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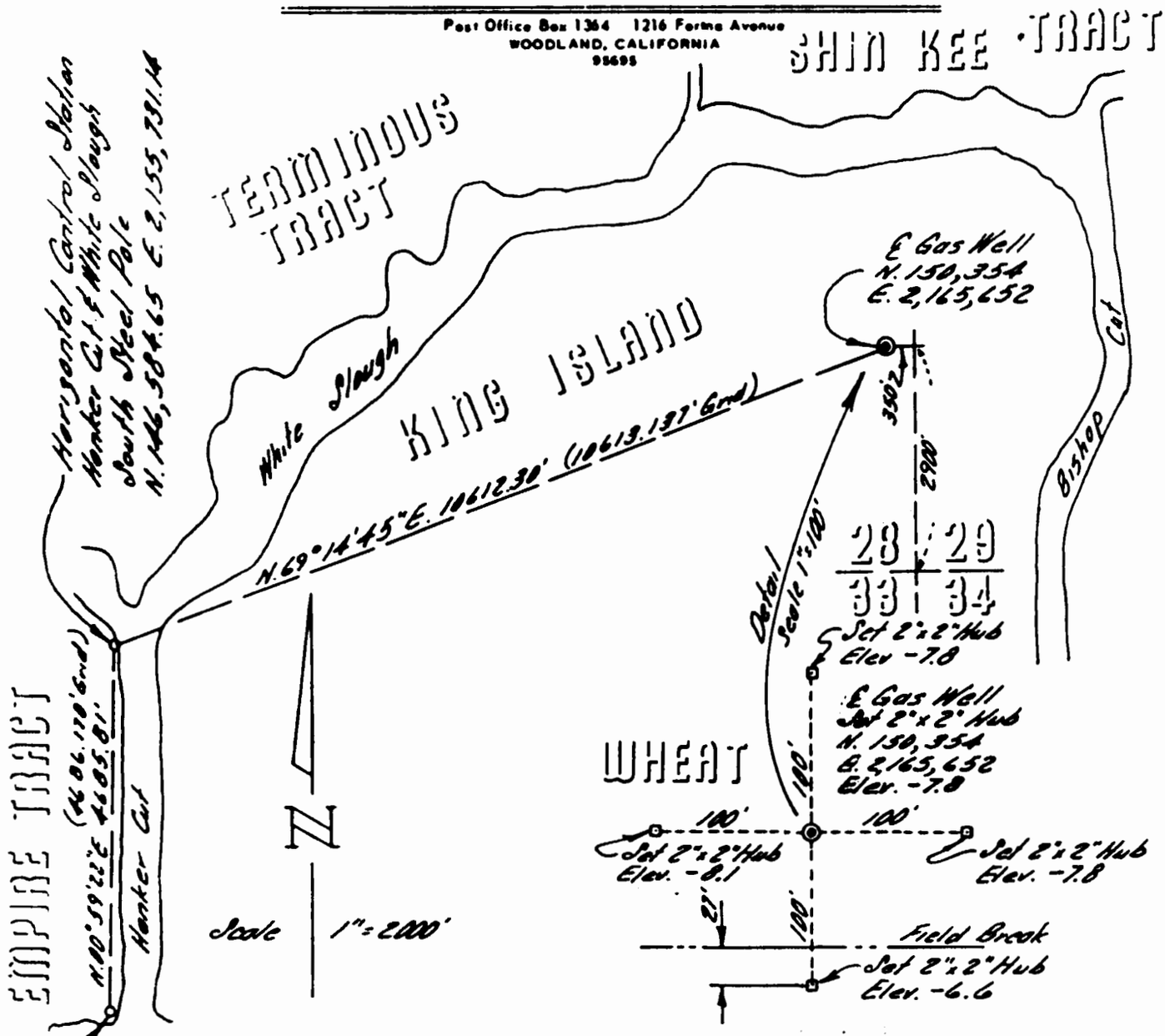
YOLO ENGINEERS & SURVEYORS, INC.
WOODLAND PH. 662-4346 • DAVIS PH. 753-2515 • WEST SACTO PH. 371-7076
Post Office Box 1364 1216 Forma Avenue
WOODLAND, CALIFORNIA
95695



GAS WELL SITE
Moresco et al Unit "A" No. 1
QUINTANA PETROLEUM
on
King Island
Projected T. 3N. R. 5E.
M.D.B.& M.
San Joaquin County, California
June 5, 1985

NOTE:
Coordinates Based on California State Cardinates System, Zone II

L E Jogen RCE # 16,698

DRILLING PROGNOSIS
QUINTANA PETROLEUM CORPORATION
Moresco et al Unit "A" #1
San Joaquin County, California

LOCATION: 7100' N and 2000' W of BM 8
Section 28, T3N-R5E

FROM SE CORNER SEC 28, 2900' N & 350' W

FORMATION TOPS:

Domengine Sand	3950'
Capay Shale	4670'
Meganos Shale	4850'
Mokelumne	4900'
H&T Shale	6230'
Starkey Sand	6340'

PROPOSED TOTAL DEPTH: 6500'

CONTRACTOR: Atlantic Oil Company

MUD PROGRAM: Atlantic Oil to provide as a part of turnkey price.

SURFACE CASING: 8 5/8", K-55 24# ST&C R-3 - set at 700'. Atlantic Oil to provide as a part of turnkey price.

PRODUCTION CASING: 6500' of 5 1/2" 15.5# K-55 LT&C R-3 casing. E. J. Prejean has located and will deliver to location when needed - (713) 651-8813. Casing program may change following log evaluation.

LOGGING PROGRAM: Log well at TD. Service company to be selected.
DIL/Sonic - TD to BSC
LDT/CNL/GR - TD to minimum (if shows warrant.
Dipmeter and two SWC guns on location.
Check with Engineering Department prior to logging for any changes.

DEVIATION SURVEYS: Take deviation survey (drift only) at 250', 450', and 700' in surface hole. Take surveys at 1000' intervals.

SPECIAL EQUIPMENT:

1. Manned mud logging unit fully operational from 700' to total depth. Vendor to be selected.
2. Totco single shot deviation tool (drift only).
3. TIW and Inside BOP to fit drill pipe with crossovers to fit drill collars on floor at all times.
4. Have flow show operational from spud.

HOLE SIZE:

12 1/4" - (0 - 700')
7 7/8" - (700' - total depth)

CUTTING SAMPLES:

Every 30' from base of surface casing to 6500' (1 set paleo and 1 set dry). Hold at rig.

CEMENT:

Surface casing cement to be supplied by Atlantic Oil as a part of the turnkey bid. Long string cement program to be designed following log evaluation.

WELLHEAD EQUIPMENT:

Casing Head: Surface sales 8 5/8" OD SW x 11" 3M casing head w/2" 125 psi ball valve and no VR plug/nipple. Located at Surface Sales, Isleton, California - (916) 777-5133. Starter head will be rented ($250) and purchased if well is productive.

CONSULTING GEOLOGIST:

To be selected.
To be on well at total depth.

DRILLING PROCEDURE:

1. Perform rig inspection, and make corrections as needed, prior to spud. Drill and survey 12 1/4" hole to +/-700'. Make conditioning trip to surface. Circulate hole clean prior to pulling out of hole.
2. Run 8 5/8" surface casing to total depth with guide shoe and insert float valve one joint above shoe. Thread-lock shoe and around insert. Run four centralizers 10' above shoe, around insert collar, and on the next two collars.

3. Cement casing as specified in cement program. Reciprocate pipe +/-15' while cementing until cement returns observed, or until pipe starts to drag. DO NOT reciprocate pipe where casing collar could stop in head if casing stuck off bottom. Should float fail to hold, pressure back up to final pump pressure and hold. Use Class "G" Neat plus 3% CaCl2 or pea gravel if cement falls in annulus.
4. Wait on cement 4 hours. Install casing head. Test welds to 50% of casing collapse. Install BOPE, including superchoke and panel. Have operational prior to drilling below surface casing. Test all BOPE to W.P. rating except annular. Test annular to 75% of rated W.P. Test casing to 1000 psi (minimum). Notify D.O.G. of BOPE test prior to testing.
5. Wear bushing not needed.
6. Drill 7 7/8" hole to total depth.
7. Pressure test BOPE every 7 days and note on IADC report. Follow D.O.G. regulations (on permit) for other BOPE test requirements.
8. Rig up mud logger at 700.
9. Conduct weekly rig inspections with toolpusher and report on morning report.
10. At TD, log as specified herein or as directed.
11. Complete with 5 1/2" casing or plug and abandon as directed.

PHONE NUMBERS:	NAME	HOME	OFFICE
	Scott Kimbrough (Denver)	(303) 969-9468	(303) 628-9211
	John Wessels (Denver)	(303) 987-0540	(303) 628-9211
	Frank Cressy (Denver)	(303) 850-9506	(303) 628-9211
	Lee Knudtson (Denver)	(303) 234-0797	(303) 628-9211
	J. M. Trotter (Houston)	(713) 580-2417	(713) 651-8639
	B. C. Craft (Houston)	-----	(713) 651-8630
	*Division of Oil & Gas District #6 Office Woodland, California Mr. Bob Hauser, Engineer		(916) 662-4683

*Verbal notification required:

1. Prior to testing BOPE at surface casing shoe and before drilling out.

2. Prior to plugging.

33/3N/5E 80

SCHLUMBERGER INDUCTION - ELECTRICAL LOG

2DIL1

COUNTY SAN JOAQUIN
FIELD or LOCATION 33 - 3N - 5E KING ISLAND
WELL PIACENTINE NO. 1
COMPANY W. B. OSBORNE, JR.

COMPANY W. B. OSBORNE, JR.
WELL PIACENTINE ~~NO.~~ 1
(077-00515)
FIELD ~~KING ISLAND~~
LOCATION 33 - 3N - 5E /
COUNTY SAN JOAQUIN
STATE CALIFORNIA 12/W

Other Surveys
1-ES (SL)
2 INCH SCALE

Location of Well
100 FT. SOUTH AND 250 FT. WEST FROM NORTHEAST CORNER OF SEC. 33-3N-5E MDB AND M

Elevation: K.B.: 10
D.F.:
or G.L.:

FILING No.

RUN No.	ONE				
Date	7-30-62				
First Reading	10490				
Last Reading	863				
Feet Measured	9627				
Csg. Schlum.	863				
Csg. Driller	863				
Depth Reached	10491				
Bottom Driller	10500				
Depth Datum	K.B.				
Mud Not.	CLAY				
Dens. | Visc.	95 | 55				
Mud Resist.	1.4 @ 96°F	@ °F	@ °F	@ °F	@ °F
" Res. BHT	.73 @ 183°F	@ °F	@ °F	@ °F	@ °F
Rmf (C)	.52 @ 183°F	@ °F	@ °F	@ °F	@ °F
Rmc (C)	.83 @ 183°F	@ °F	@ °F	@ °F	@ °F
" pH	8.5 @ 96°F	@ °F	@ °F	@ °F	@ °F
" Wtr. Loss	5.0 CC 30 min.	CC 30 min.	CC 30 min.	CC 30 min.	CC 30 min.
Bit Size	8 3/4"				
Spcgs.—AM	16"				
MN	34' 6"				
IND.	6FF40				
Opr. Rig Time	3 HOURS				
Truck No.	2532 SAC				
Recorded By	MARCHETTE				
Witness	WATSON				

DIVISION OF OIL AND GAS
RECEIVED
AUG 23 1962
WOODLAND, CALIFORNIA

FOLD HERE

REMARKS C.D. USED ; S.O. = 1 1/2"

Cartridge No. IRC-G 507
Panel No. IRP-F 141
Sonde No. IRS-K 258
SBR = 2

CONDUCTIVITY millimhos/m = 1000/ohms. m²/m

INDUCTION 0 1000

RESISTIVITY ohms. m²/m

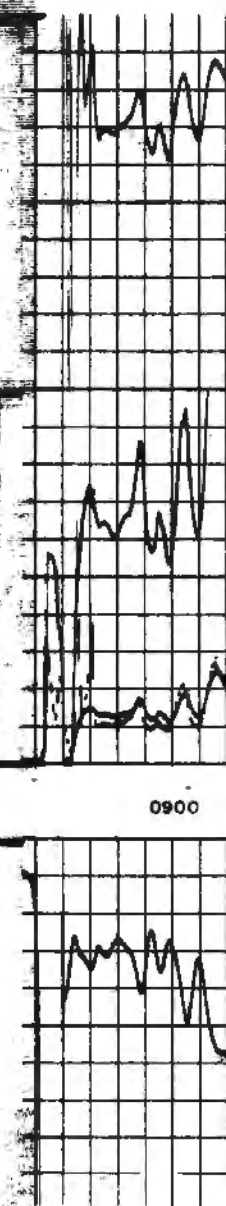
0 AMP. SHORT NORMAL 6
16" NORMAL 0 30 0 300

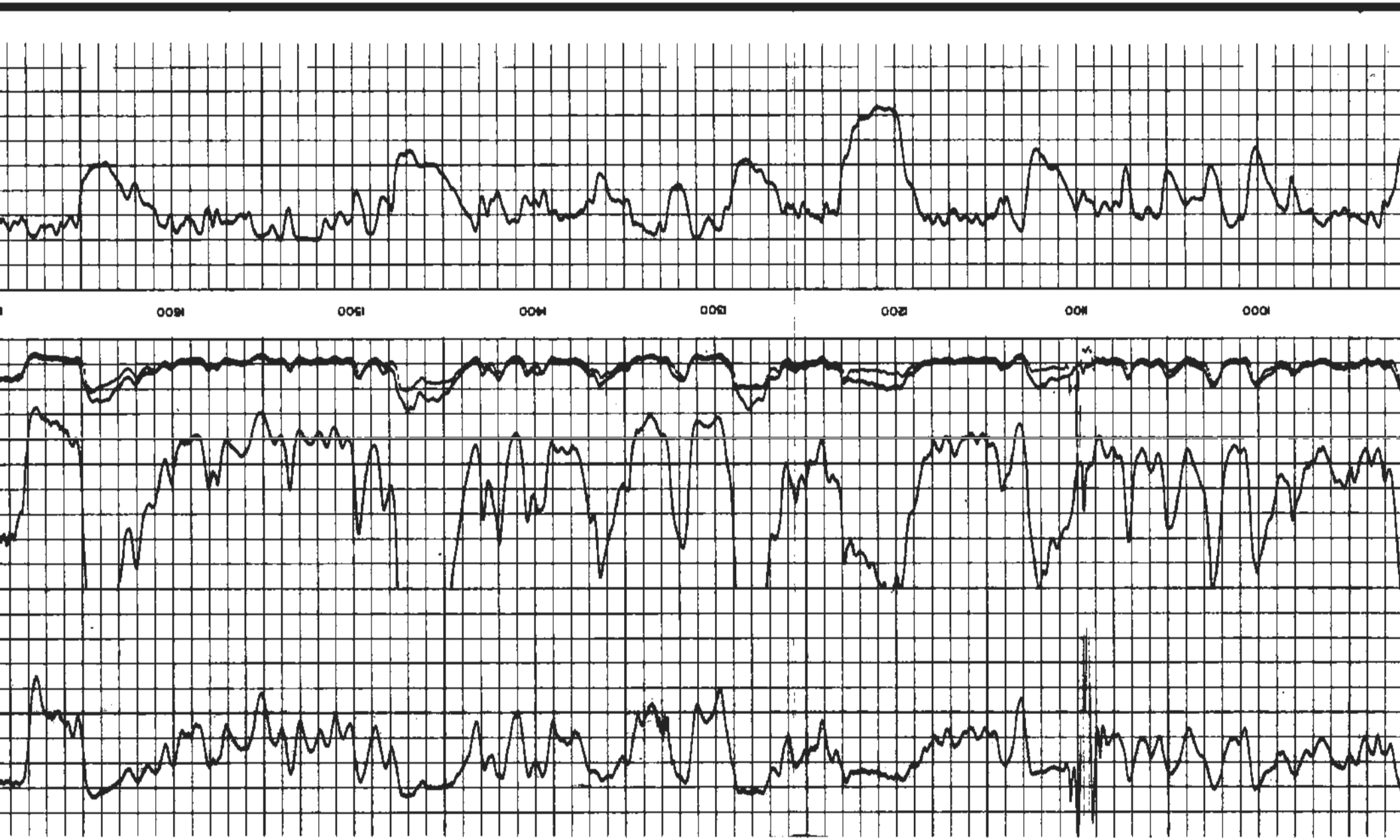
INDUCTION 0 30 0 300

DEPTHS 0900

SPONTANEOUS-POTENTIAL millivolts

10 — +





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Louisville
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4200
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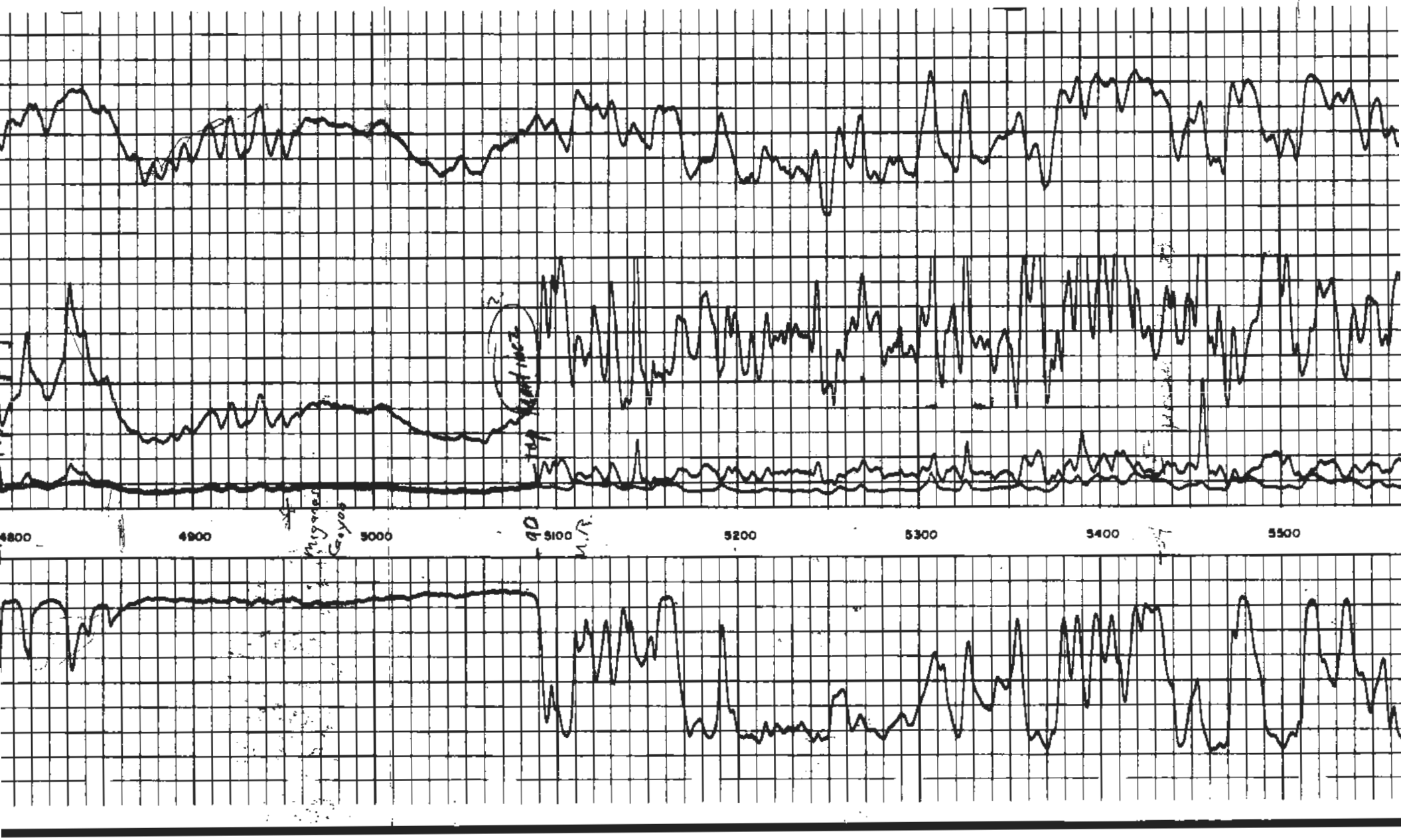
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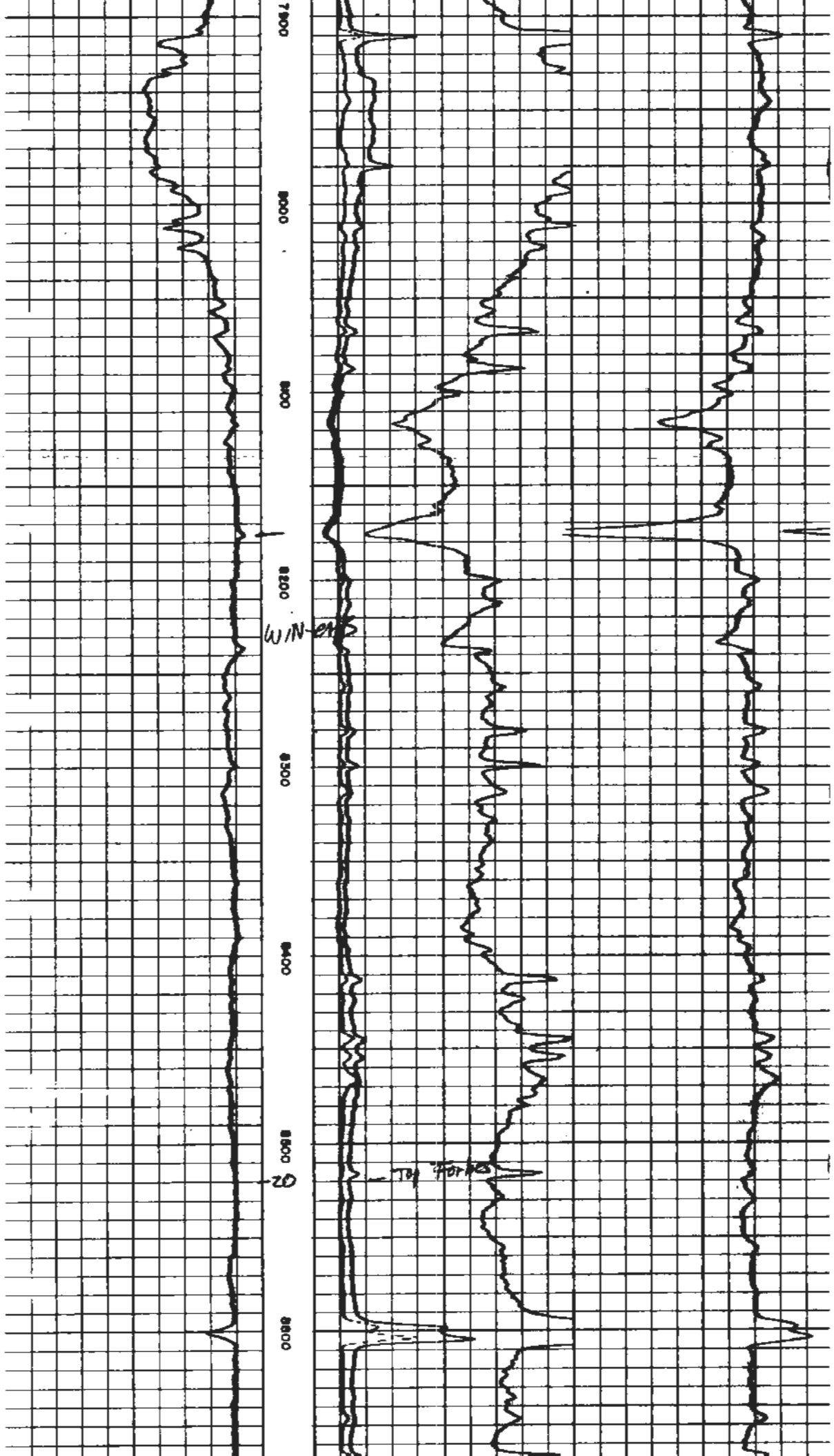
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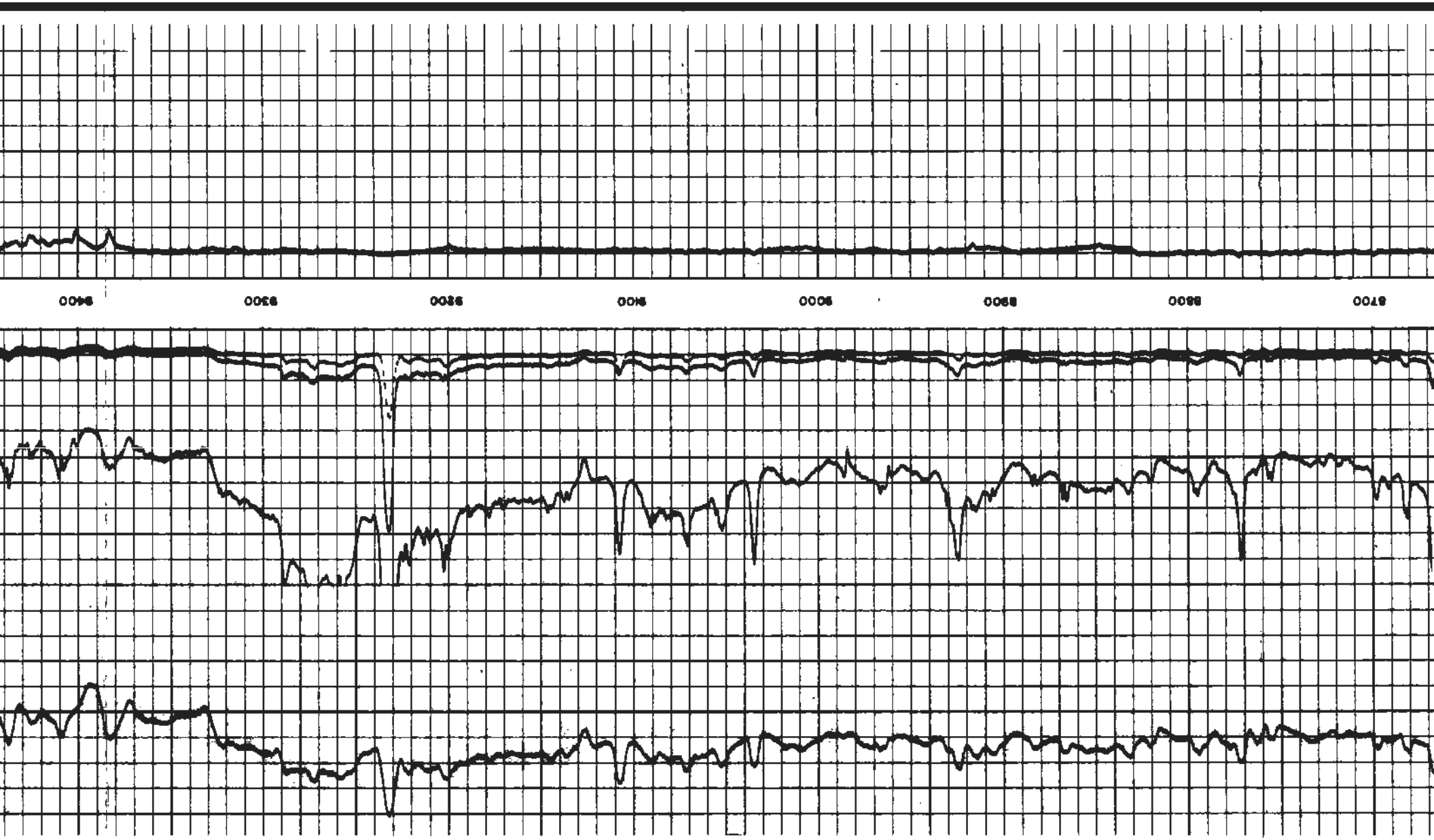

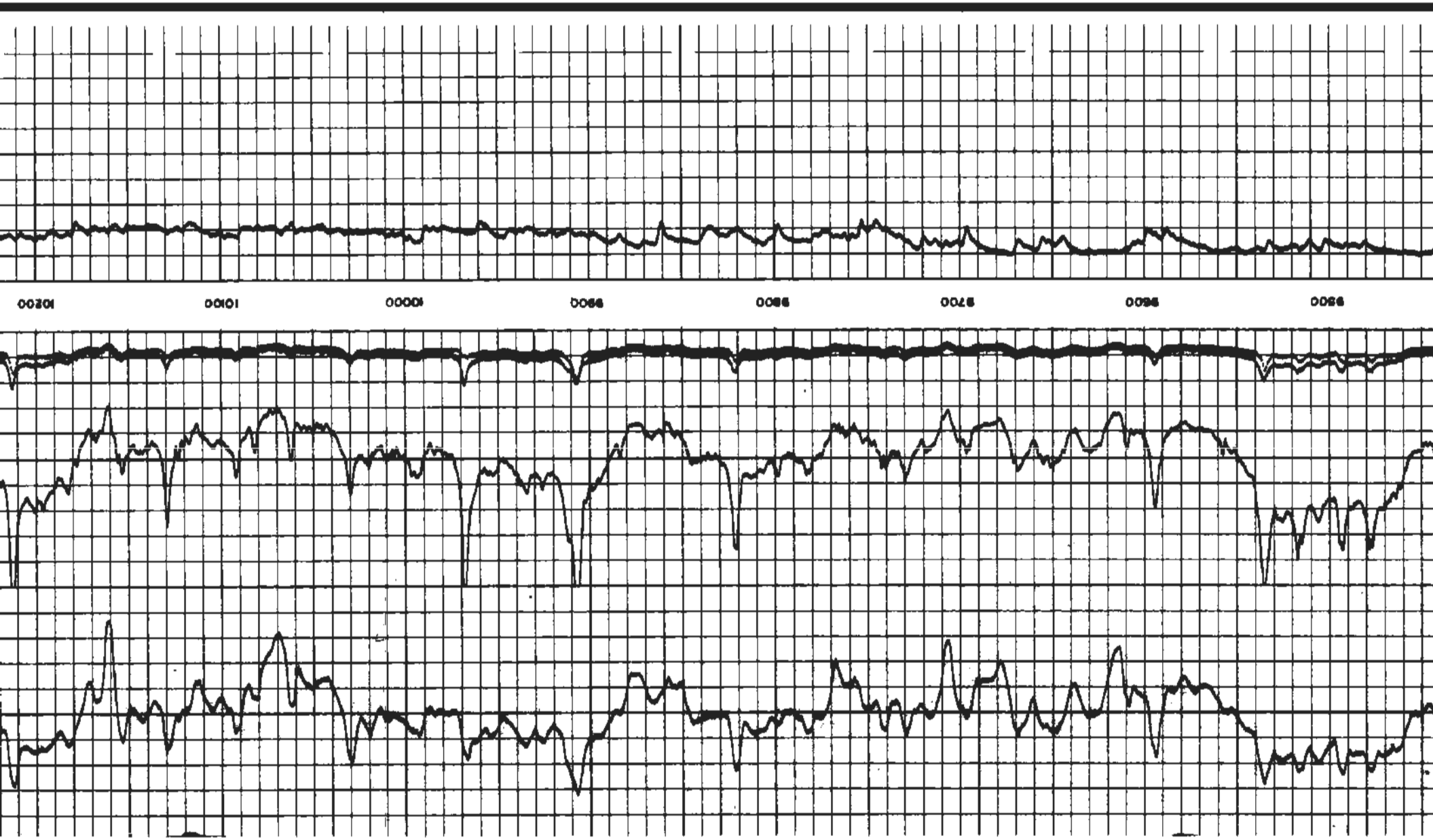

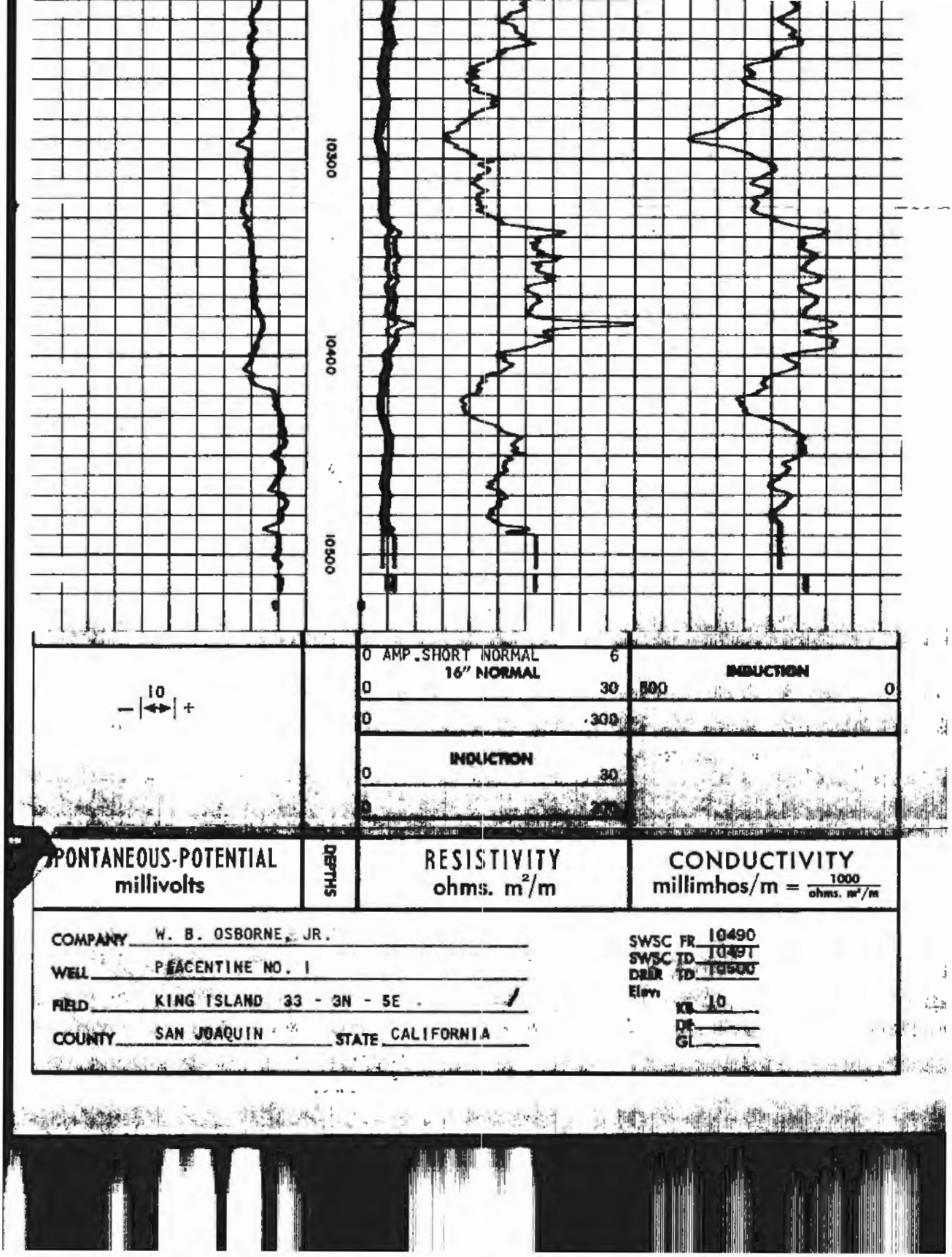
10500
10400
10300
0 AMP. SHORT NORMAL 6
16" NORMAL
0 30
0 300
INDUCTION
0 30
0 300
INDUCTION
500 0
— 10 +
SPONTANEOUS-POTENTIAL
millivolts
DEPTHS
RESISTIVITY
ohms. m²/m
CONDUCTIVITY
millimhos/m = 1000 / ohms. m²/m
COMPANY W. B. OSBORNE, JR.
WELL PEACENTINE NO. 1
FIELD KING ISLAND 33 - 3N - 5E
COUNTY SAN JOAQUIN STATE CALIFORNIA
SWSC FR 10490
SWSC TD 10491
DRLR TD 10500
Elev.
KB 10
DF
GL

FORM 159 (9-49)

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, California

November 16, 1962

Mr. Warren H. Atherton
320 Wells Fargo Bank Bldg.
Stockton, California
Agent for W. D. GIBSON, JR.

DEAR SIR:

077 00515

Your report of abandonment of Well No. "Piacentine" 1, Sec. 33, T. 3 N, R. 5 E, M.D. B. & M., -- field, San Joaquin County, dated August 15, 1962, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

Bond No. 15330-13-6033-62
WJBidja
cc: Co., San Antonio

E. R. MURRAY-AARON
State Oil and Gas Supervisor

By R. M. Barger
Deputy Supervisor

59444 2-62 6M SPO

MAP & BOOK

STATUS

Completed Producing _____
Recompleted Producing _____
Completed Abandoned _____
Uncompleted Abandoned ✓
Idle _____

RECORDS

Received		Needed
✓	Well Summary	
✓	History	
✓	Log & Core	
✓ Lge ___ Sm	Elec. Log(s)	___ Lge ___ Sm
	Direct. Survey	
SONIC	Other	

Location OK
Elevation OK
Release Bond Yes
Hold Bond ____ Reason _____
Final letter Yes
150b 10-16-62
170 _____
121 ✓
card _____

WJH
10/31/62

Form 19

Well location transferred 2/11/83 from 100's

350W fr NE cor old projected section corner coordinates

to 200S 250W from NE cor new projected section

coordinates of Sec. 33/3N/5E.

Eric Senter:rmc

Feb. 1983

FORM 100

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

SUBMIT IN DUPLICATE

Operator W.B. Osborn, Jr. Well No. Piacentine

Sec. 33, T. 3N, R. 5E, M.D. B. & M. ~~Wildcat~~ Field San Joaquin County.

Location 2100' West along property line and 650' South at right angles to said line from the
(Give location from property or section corner, or street center lines)
NE corner of the property Elevation of ground ~~above~~ sea level 4' feet (-4')
below

All depth measurements taken from top of Kelly Bushing which is 13.6 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

In compliance with Sec. 3215, of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date August 15, 1962

Signed Jack Watson, Jr.

Title General Supt. & Engineer
(President, Secretary or Agent)

(Engineer or Geologist) (Superintendent)

Commenced drilling July 17, 1962

Completed drilling July 30, 1962

Total depth 10,500' Plugged depth 728'

Junk None

	GEOLOGICAL MARKERS	DEPTH
UE	Markley	3820'
UE	Nortonville	3940'
ME ✓	~~Domegine~~	~~4190'~~
ME ✓	Copay	4792'
LE	Martinez	5090'
~~UK~~	~~Moreno (Top Cretaceous)~~	~~5434'~~
UK	Forbes	8520'

Geologic age at total depth: Forbes (Cretaceous)

Commenced producing None (Date) Flowing/gas lift/pumping (Cross out unnecessary words) Name of producing zone None

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production	None					
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cementing if through perforation
9-5/8"	863	4' below ground level	36#	New	Smls	J-55	13-3/4	510	

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

None

DIVISION OF OIL AND GAS
RECEIVED
JUN 20 1962
WOODLAND, CALIFORNIA

077 00515

Electrical Log Depths 10,500 (Attach Copy of Log)

SPO

FORM 103

SUBMIT IN DUPLICATE

STATE OF CALIFORNIA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR W. B. Osborn, Jr. FIELD WC

Well No. 1 Piacentine, Sec. 33, T. 3N, R. 5E, B. & M.

Date August 6, 1962 Signed Jack Watson, Jr.

Box 6767, San Antonio 9, Texas TA-6-8656 Title Jack Watson, Jr., Prod. Supt.

(Address) (Telephone Number) (President, Secretary or Agent)

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data.

Date	
7-18-62	Spudded. Drilled 12-3/4" hole to 863'.
7-19-62	Ran 9-5/8 36# J-55 casing to 863'. Cemented with 340 sx. class "A" cement with 4% gel followed by 100 sx. neat cement with 2% ca.cl. cemented on outside of casing thru 1" pipe from top of cement at 80' with 70 sx. neat cement with 2% ca.cl. Had good returns to surface.
7-20-62	Tested surface pipe and B.O.P. at 1500#. Drilled cement from 838 to shoe @ 863. Started drilling 8-3/4" hole.
7-30-62	Reached T.D. of 10,500'. Ran Schlumberger Induction log and Sonic log. Had minor shale gas shows on mud logger but no commercial shows on Induction and Sonic logs.
7-31-62	With drill pipe open ended at 950', Halliburton equalized 140 sx. class "A" cement containing 2% ca.cl. Job completed at 1:00 A.M. At 5:30 A.M. found hard cement at 728'. Witnessed by George Beacroft, Division of Oil and Gas. Put 10' cement plug in top of surface casing. Cut off 9-5/8 at bottom of cellar and welded plate across top of casing.

DIVISION OF OIL AND GAS
RECEIVED
AUG 8 1962
WOODLAND, CALIFORNIA

FORM 109-D

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Special Report on Operations Witnessed

No. T662-304

Mr. Warren H. Atherton
520 Wells Fargo Bank Bldg.
Stockton, California

Woodland, Calif.
September 7, 1962

Agent for W. B. OSBORN, JR.

DEAR SIR:

Operations at well No. "Biacentine" 1, Sec. 33, T. 3 N, R. 5 E, M.D. B & M. Field, in San Joaquin County, were witnessed on July 31, 1962. Mr. G. W. Beecroft, representative of the supervisor was present from 5:30 a.m. to 6:00 a.m. There were also present L. Aulgur, Drilling Foreman and G. Meekins, Driller

Present condition of well: 9 5/8" cem. 863', T.D. 10,500', plugged with cement 950'-728'.

The operations were performed for the purpose of witnessing the location and hardness of a cement plug placed from 950' to 728' in the process of abandonment.

Mr. Aulgur reported:

1. On July 19, 1962, the 9 5/8" - 36 lb. surface casing was cemented in a 13 3/4" hole at 863' with 340 sacks of cement mixed with 4% gel, followed by 100 sacks of cement treated with 2% calcium chloride. Cement did not return to the surface.
2. 70 sacks of cement treated with 2% calcium chloride was placed around the 9 5/8" casing through 1" pipe hanging at 80'.
3. Cement returned to the surface.
4. An 8 3/4" hole was drilled to 10,500'.
5. On July 31, 1962, 120 sacks of cement mixed with 2% calcium chloride was pumped into the hole through drill pipe hanging at 950', calculated to fill to 646'.

THE ENGINEER NOTED that the cement plug at the depth of 725' supported all the weight of the drill pipe.

THE LOCATION AND HARDNESS OF THE CEMENT PLUG AT 728' ARE APPROVED.

NOTE: The issuance of this report has been delayed pending receipt of abandonment notice which was received on August 30, 1962.

GWB:djs
cc: Co., San Antonio

E. R. MURRAY-AARON
State Oil and Gas Supervisor

By R. M. Barger Deputy

56221 1-62 15M ② SFO

FORM 111

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 662-445

Mr. Warren H. Atherton
520 Wells Fargo Bank Bldg.
Stockton, California

Woodland, Calif.
September 7, 1962

Agent for W. B. OSBORN, JR.

DEAR SIR:

Your proposal to abandon Well No. "Piacentine" 1, Section 33, T. 3 N, R. 5 E, M.D. B. & M., -- Field, San Joaquin County, dated Aug. 15, 1962, received Aug. 30, 1962, has been examined in conjunction with records filed in this office. Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:
"THE PRESENT CONDITION OF THE WELL IS:
1. Total Depth: 10,500'
2. Complete casing record, including plugs:
9-5/8" casing at 863'.
Cement plug 728-950'.
10' cement plug in top of surface.
3. Last Produced No Production
Additional Data for Dry Hole
4. Oil or Gas showings and results of tests:
No commercial shows.
No tests.
Minor gas shows on mud logger.
5. Stratigraphic markers and depths:
See Form 100
6. Formation at bottom: Forbes (Cretaceous)
7. Base of fresh water sands: 800' "

PROPOSAL:
"THE PROPOSED WORK IS
Pipe is cut off at bottom of cellar and steel plate welded across casing.
Pits will be filled and location restored to former condition."

DECISION:
THE PROPOSAL COVERING WORK ALREADY COMPLETED UNDER PRIOR AGREEMENT IS APPROVED.

Bond No. 15330-13-8033-62
RMB:djs
cc: Co., San Antonio

54957 12-61 50M SPO

E. R. MURRAY-AARON, State Oil and Gas Supervisor

By R. M. Barger, Deputy

FORM 108. 20248 5-60 15M ④ SPO

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

DIVISION OF OIL AND GAS

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin; one copy only

San Antonio 9, TTxas Calif. August 15 1962

DIVISION OF OIL AND GAS

In compliance with Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon Well No. (W.B. Osborn, Jr. / Piacentine #1, Sec. 33, T. 3N, R. 5E, M.D. B. & M., (Wildcat) Field, San Joaquin County, commencing work on Immediately 19___.

THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 10,500'

2. Complete casing record, including plugs:

9-5/8" casing at 863'.
Cement plug 728-950'.
10' cement plug in top of surface.

3. Last Produced No Production
(Date) (Oil, B/D) (Water, B/D)

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:
No commercial shows.
No tests.
Minor gas shows on mud logger.

5. Stratigraphic markers and depths:

See Form 100

6. Formation at bottom: Forbes (Cretaceous)

7. Base of fresh water sands: 800'

THE PROPOSED WORK IS

Pipe is cut off at bottom of cellar and steel plate welded across casing.

Pits will be filled and location restored to former condition.

MAP	WELL BOOK	CARDS	BOND	FORMS 1144	FORMS 1121
W6-1	9/4/62	✓	15350-15 8-62	✓	✓

DIVISION OF OIL AND GAS
RECEIVED
AUG 20 1962
WOODLAND, CALIFORNIA

Box 6767, San Antonio 9, Texas
(Address)

Taylor 6-8656
(Telephone No.)

W.B. OSBORN, JR.
(Name of Operator)

By Jack Watson, Jr.

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

FORM 111

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 662-329

Mr. Warren H. Atherton
520 Wells Fargo Bank Bldg.
Stockton, California
Agent for W. B. OSBORN, JR.

Woodland, Calif.
July 12, 1962

DEAR SIR:

Your proposal to drill Well No. "Piacentine" 1, Section 33, T. 3 N, R. 5 E, M.D. B. & M., -- Field, San Joaquin County, dated July 5, 1962, received July 9, 1962, has been examined in conjunction with records filed in this office.

Present conditions as shown by the records and the proposal are as follows:

THE NOTICE STATES:

"Legal description of mineral-right, consisting of 516.12 acres, is as follows: 516.12 acres comprising the South 500 feet of Section 28; the South 500 feet of SW/4 of Section 27; the North Half of Section 33; and the Northwest Quarter of Section 34; Township 3 North, Ranch 5 East.

Do mineral and surface leases coincide? Yes X

Location of Well: 2100 feet West along north property line and 650' feet South at right angles to said line from the Northeast corner of property. Also being 250' west and 100 feet south of northeast corner of projected section 33 T-3N-5E

Elevation of ground above sea level approx. 4 feet below sea level datum.

All depth measurements taken from top of Kelly Bushing which is 13.6 feet above ground."

PROPOSAL:

"PROPOSED CASING PROGRAM

Size of Casing Inches A.P.I.	Weight	Grade and Type	Top	Bottom	Cementing Depths
9-5/8	36#	J-55	Surface	850'	Cement back to surface
4-1/2	11.60	J-Buttress & J-LT&C	Surface	8000	4½ csg. will be cemente
4-1/2	11.60	N-80	8000'	100 ft. below producing sand.	500' above any producing sand.

Intended zone (s) of completion: Unknown Estimated total depth 10,500

It is understood that if changes in this plan become necessary we are to notify you immediately."

DECISION:

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Mud fluid of sufficient weight and proper consistency to prevent blow-outs shall be used in drilling, and the column of mud fluid shall be maintained to the surface at all times, particularly while pulling the drill pipe.
2. Adequate blow-out prevention equipment shall be provided and maintained ready for operation at all times.
3. In the event the 4½" casing is cemented below the surface casing, fresh waters shall be protected by cement behind the casing. Sufficient cement shall be used to fill to at least 100' above the base of fresh waters.
4. This Division shall be notified:
   a. To inspect blow-out prevention equipment prior to drilling below a depth of 1500'.
   b. To witness a test of the 4½" water shut-off immediately above the objective zones.

E. R. MURRAY-AARON, State Oil and Gas Supervisor

By R. M. Burgess, Deputy

Bond No. 15330-13-8033-62 dat

MMB:dja

cc: Co., San Antonio

115

54357 12-61 50M SPO

FORM 105

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and surety bond must be filed before drilling begins

077-00515

San Antonio, Texas ~~exxx~~ July 5, 1962 19

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division III, Article 4, Public Resources Code, notice is hereby given that it is our intention to commence drilling well No. 1 Piacentine, Sec. 33, T. 3N, R. 5E, ____ B. & M., wildcat Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 516.12 acres, is as follows: 516.12 acres comprising the South 500 feet of Section 28; the South 500 feet of SW/4 of Section 27; the North Half of Section 33; and the Northwest Quarter of Section 34; Township 3 North, Range 5 East.
(Attach map or plat to scale)

Do mineral and surface leases coincide? Yes X No ____ If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of Well: 2100 feet West (Direction) North property along ____ line and 650' feet South (Direction) at right angles to said line from the Northeast corner of property. Also being 250' west and 100 feet south of northeast corner of projected section 33 T-3N-5E

Elevation of ground above sea level approx. 4 feet below sea level datum. 14

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table or Kelly Bushing) which is 13.6 feet above ground.

E-NF
NE¼

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES A.P.I.	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS
9-5/8	36#	J-55	Surface	850'	Cement back to surface
4-1/2	11.60	J-Buttress & J-LT&C	Surface	8000	4½ csg. will be cemented
4-1/2	11.60	N-80	8000'	100 ft. below producing sand.	500' above any producing sand.

Intended zone(s) of completion: Unknown Estimated total depth: 10,500 (Depth, top and bottom)

DIVISION OF OIL AND GAS
RECEIVED
JUL 1962
9 dja
WOODLAND, CALIFORNIA

077 00515

MAP	MAP BOOK	CARDS	BOND (Name)	FILED 114	FILED 121
	W6-1 7-9-62 jew	✓	15330-18-033-62	✓	✓

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address Box 6767, San Antonio, Texas

Telephone Number TA-6-8656

W. B. Osborn, Jr. (Name of Operator)

By Jack Watson, Jr.

Type of Organization Individual (Corporation, Partnership, Individual, etc.)

85224 12-61 20M △ SPO

OTHER

HALLIBURTON

EXCELL 2000

THERMAL MULTIGATE
DECAY
LITHOLOGY

COMPANY SIERRA RESOURCES INC.
WELL PIACENTINE 1-27
FIELD RIO BLANCO PROSPECT
COUNTY SAN JOAQUIN STATE CALIF.

COMPANY SIERRA RESOURCES INC.

WELL PIACENTINE 1-27

FIELD RIO BLANCO PROSPECT

COUNTY SAN JOAQUIN STATE CALIF.

API No. 04-077-20468 2.048 ←
Location 660 FEET NORTH AND 660 FEET EAST FROM THE SOUTH-WEST CORNER OF:

Sect 27 Twp 3N Rge 6E

Other Services
PERF.

Permanent Datum G.L. Elev 6.60
Log measured from K.B. 12.0 ft. above perm. datum
Drilling measured from K.B.

Elev.: K.B. 18.60
D.F. —
G.L. 6.60

Date	03/09/87			
Run No.	ONE			
Depth - Driller	4730.00			
Depth - Logger	4738.00			
Bottom - Logged Interval	4722.00			
Top - Logged Interval	4480.00			
Type fluid in hole	WATER			
Salinity, PPM NaCl	2.0			
Density	8.3			
Level	1800.00			
Max. rec. temp., deg F.	N/R			
Operating rig time	1.0 HOURS			
Hoist Unit / Location	51886 / WDLD.	/	/	/
Inst. Unit / Location	51886 / WDLD	/	/	/
Recorded by	JOHN GUNBY			
Witnessed by	MR. D. ESSEPTS			

BOREHOLE RECORD			CASING & TUBING RECORD			
Bit	From	To	Size	Wgt.	From	To
			8.838	24.0	SURF.	723.00
			5.50	15.0	SURF.	6000.00
			2.788	6.5	SURF.	4694.00

Fold Here

Service Ticket No.: 201307 API Serial No.: 04-077-20468 PGM Version: XL 12.40

EQUIPMENT DATA

GAMMA NEUTRON GENERATOR

Run No.	ONE			Run No.	ONE			
Serial No.	17			Gen Neg s/n	15			
Model No.	TMDL			Inst Neg s/n	15			
Diameter	1.686			Case Diameter	1.595			
Detector Model No.	17			Detector 1 s/n	15			
Type	NAL			Detector 2 s/n	15			
Length	13.4			Generator s/n	86489			
Distance to Source	4.0			Fluid Excluder	NAL			

LOGGING DATA

GENERAL				GAMMA			NEUTRON GENERATOR				
Run	Depth		Speed	Filter	Scale		Input Filter	Output Filter	Borehole	Scale	
No.	From	to	Ft / Min	Type	L	R	Type		Option	L	R

Date of Last Survey

Remarks:

THANK YOU FOR USING HALLIBURTON

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT FOR ANY LOSS, DAMAGES OR EXPENSES RESULTING FROM THE USE THEREOF.

HALLIBURTON

PRIMARY PRESENTATION

HALLIBURTON

Version No: 2.40 | hc2.0
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Control File: plot_01_1.spc
Raster File: 0808_1640_r0501.plot_01_1

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Bottom Depth: 4794.00
Database Time: 03-08-07 16:27:17

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NEAR BOBE SI				INTRINSIC SI		
240		40		60	CU	0
RNFC				RTMD		NEAR COUNTS
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GAS INDEX 1				RICE		FAR COUNTS
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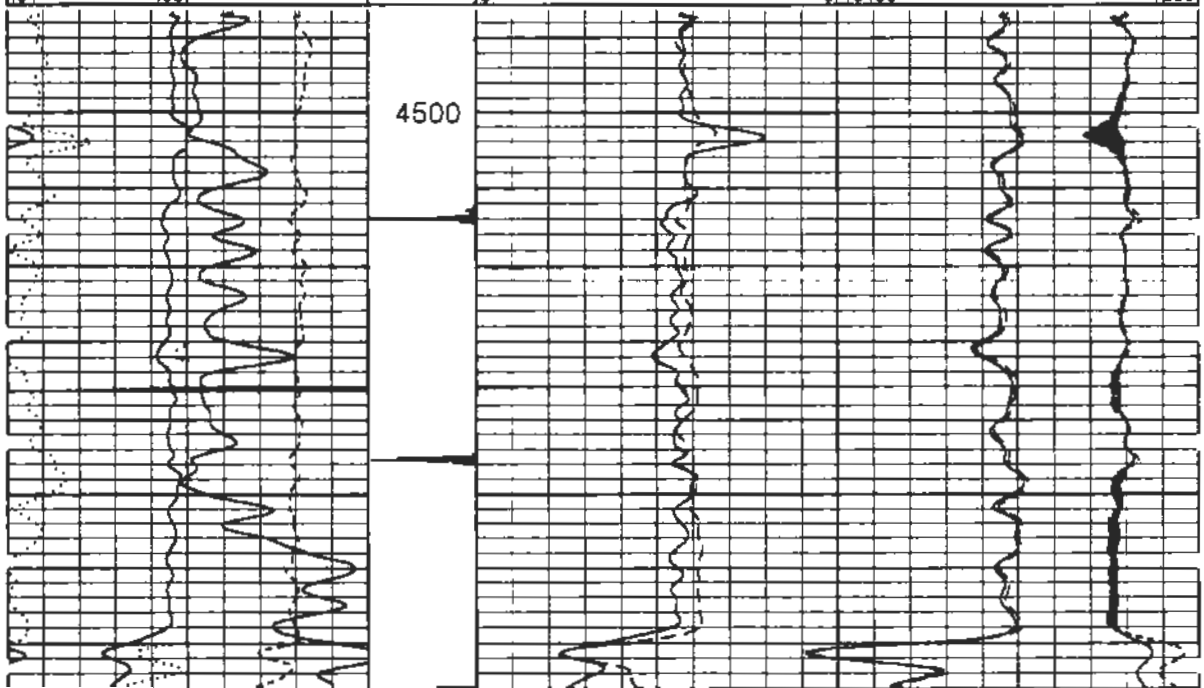

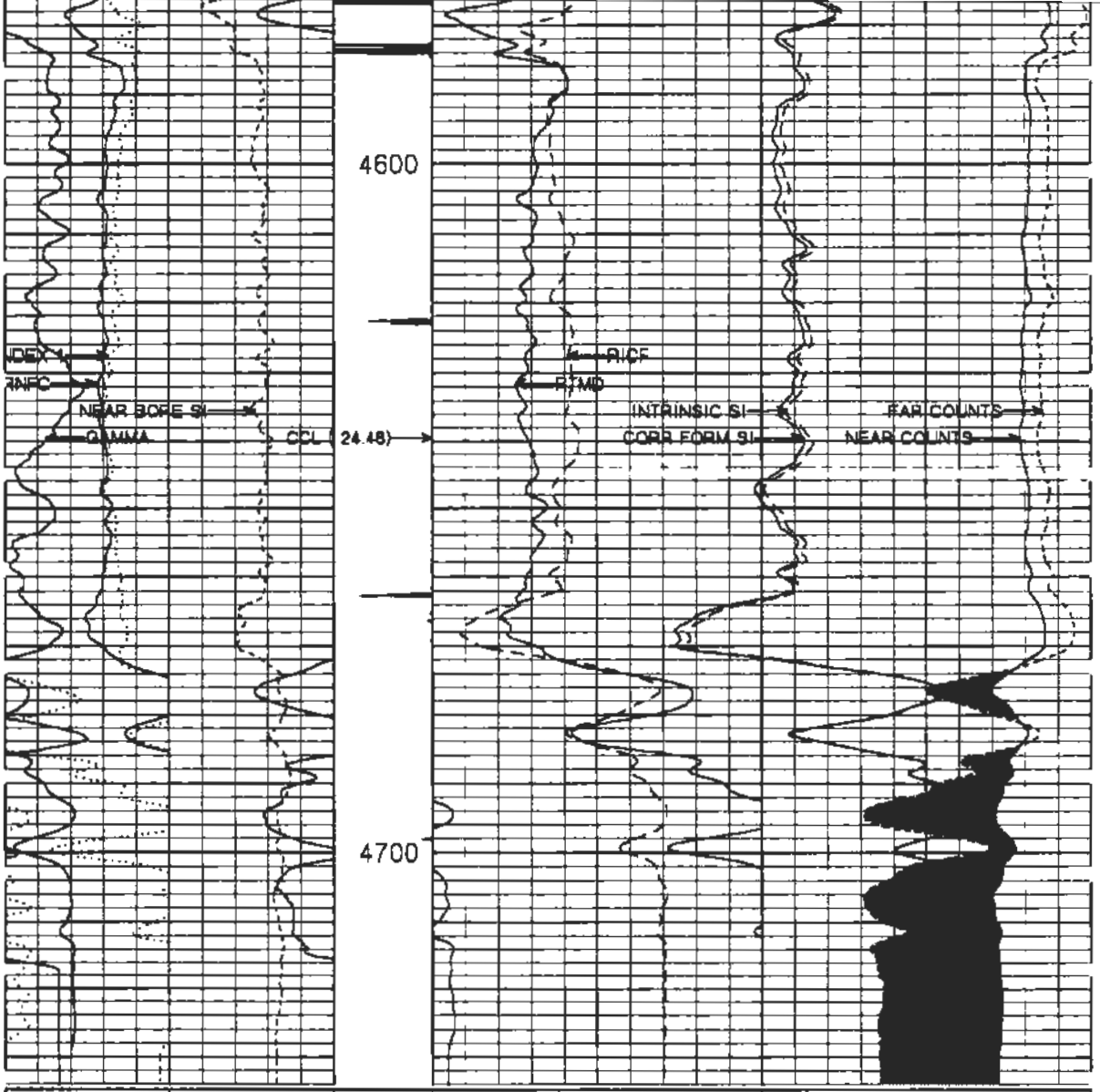

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.01	.03			5 0		10450	1250
RNEC				RTMD		NEAR COUNTS	
6	1			9	4	60000 COUNTS	0
NEAR BORE SI				INTRINSIC SI			
240	40			60	CU		0
GAMMA		ccl (24.48)		CORR FORM SI			
-25	API 125	3000	60	60	CU		0

HALLIBURTON

Version No: 2.40 | hc:2.0
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Bottom Depth: 4734.00

Database Time: 09-08-97 18:27:17

REPEAT SECTION PRIMARY PRESENTATION

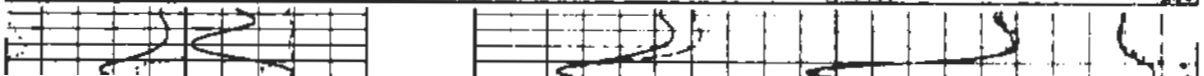
HALLIBURTON

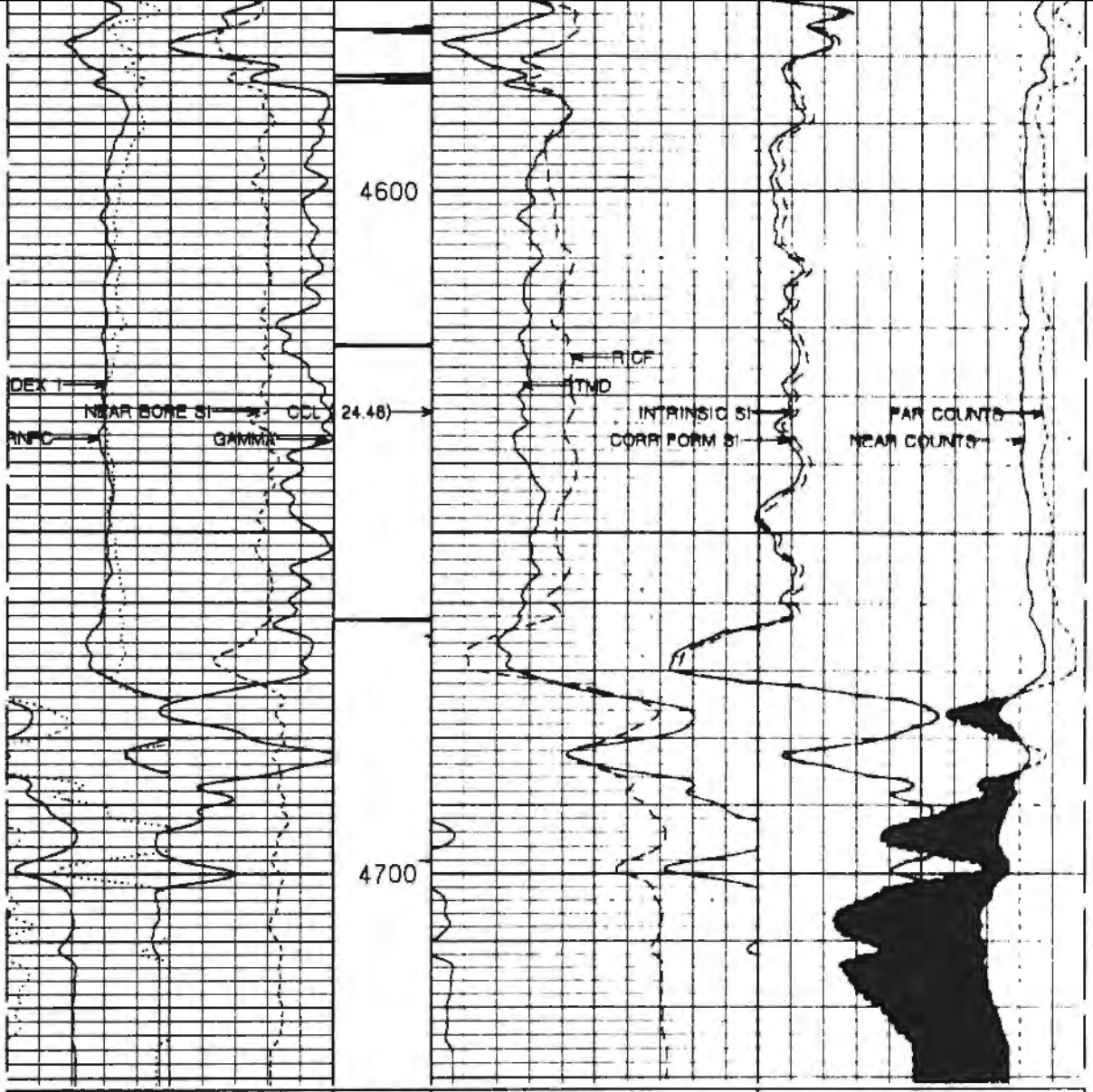
Version No: 2.40 | hc:2.0
Data File: 0908_1540_r0501.11.cle
Control File: plot_01_1.spo
Raster File: 0908_1540_r0501.plot_01_1

Top Depth: 4682.75
Bottom Depth: 4731.00

Database Time: 09-08-97 18:25:11

GAMMA				CORR FORM SI			
-25	API 125	3000	60	60	CU		0
NEAR BORE SI				INTRINSIC SI			
240	40			60	CU		0
RNEC				RTMD		NEAR COUNTS	
6	1			9	4	60000 COUNTS	0
GAS INDEX 1				RICE		FAR COUNTS	
.01	.03			5	0	10450	1250





GAS INDEX 1 .01 .03		RICF 5 0
RNFC 6 1		RTMD 9 4
NEAR BORE SI 240 40		INTRINSIC SI 60 CU 0
GAMMA -25 API 125	CCL (in.) 3000 50	CORR FORM SI 60 CU 0
		FAR COUNTS 10450 1250
		NEAR COUNTS 60000 COUNTS 0

HALLIBURTON

Version No: 2.40 | hc:2.0
Data File: 0906_1540_r0501.11.cls
Control File: plot_01_1.spc
Raster File: 0906_1540_r0501.plot_01_1

Top Depth: ------
Bottom Depth: 4791.00
Database Time: 09-06-97 16:26:11

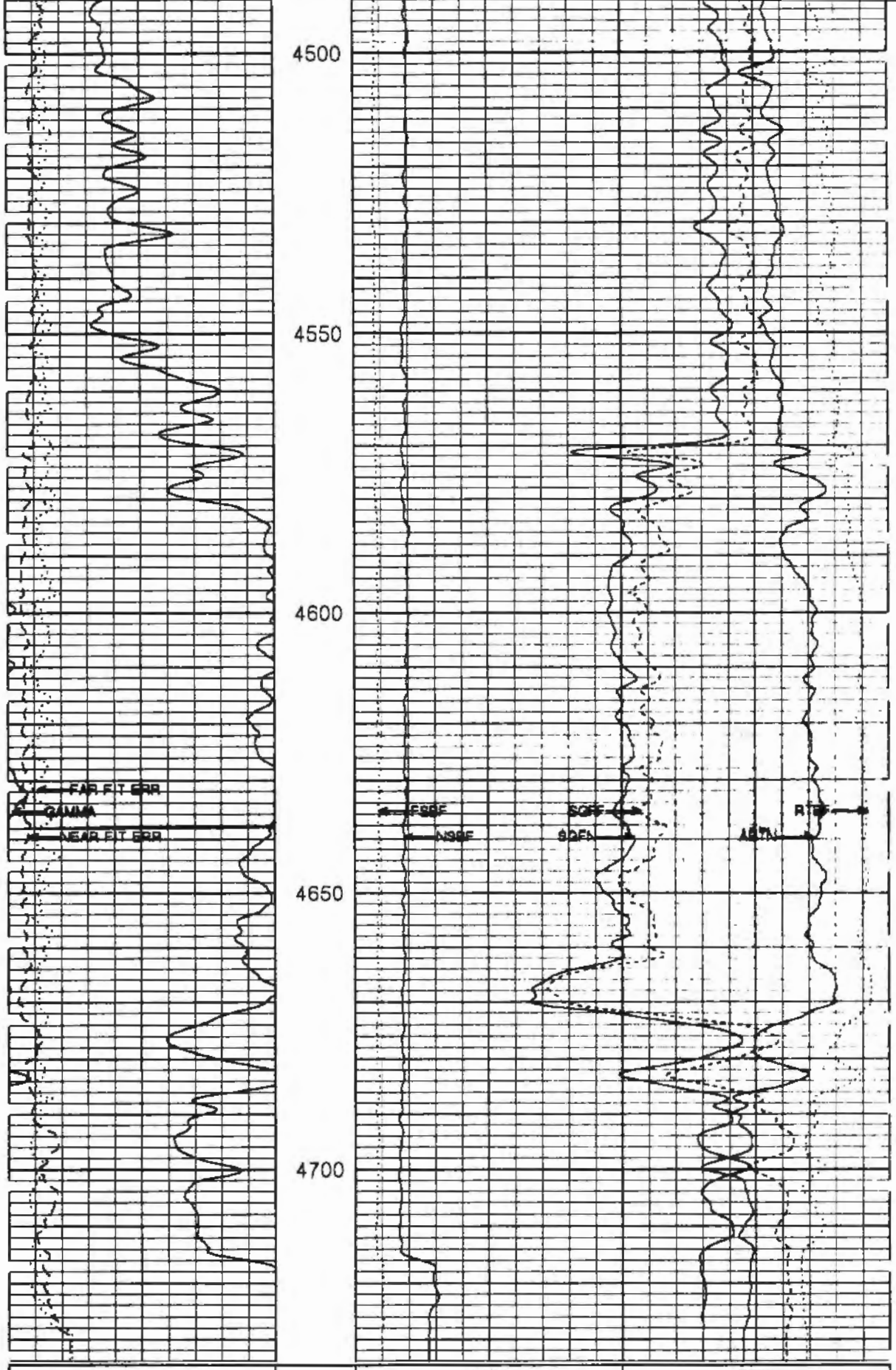
MAIN LOG PASS QAULITY PRESENTATION

HALLIBURTON

Version No: 2.40 | hc:2.0
Data File: 0906_1540_r0501.2.cls
Control File: plot_01_1.spc
Raster File: 0906_1540_r0501.plot_01_1

Top Depth: 4487.00
Bottom Depth: 4734.00
Database Time: 09-06-97 15:43:50

NEAR FIT ERR		SGFN 60 0
DECP 0 20		SGFF 60 0
GAMMA 0 API 150		NSBF 0 1000
FAR FIT ERR 0 20		ABTN 60000 0
		FSBF 0 1000
		RTBF 5 0



FAR FIT ERR		FSBF	RTBF
0	20	0 1000	5 0
GAMMA		NSBF	ABTN
0 API	150	0 1000	60000 0
NEAR FIT ERR		SQFF	
0 DECP	20	60	0
		SQFN	
		60	0

Version No: 2.40 | hc:2.0

Top Depth: ——

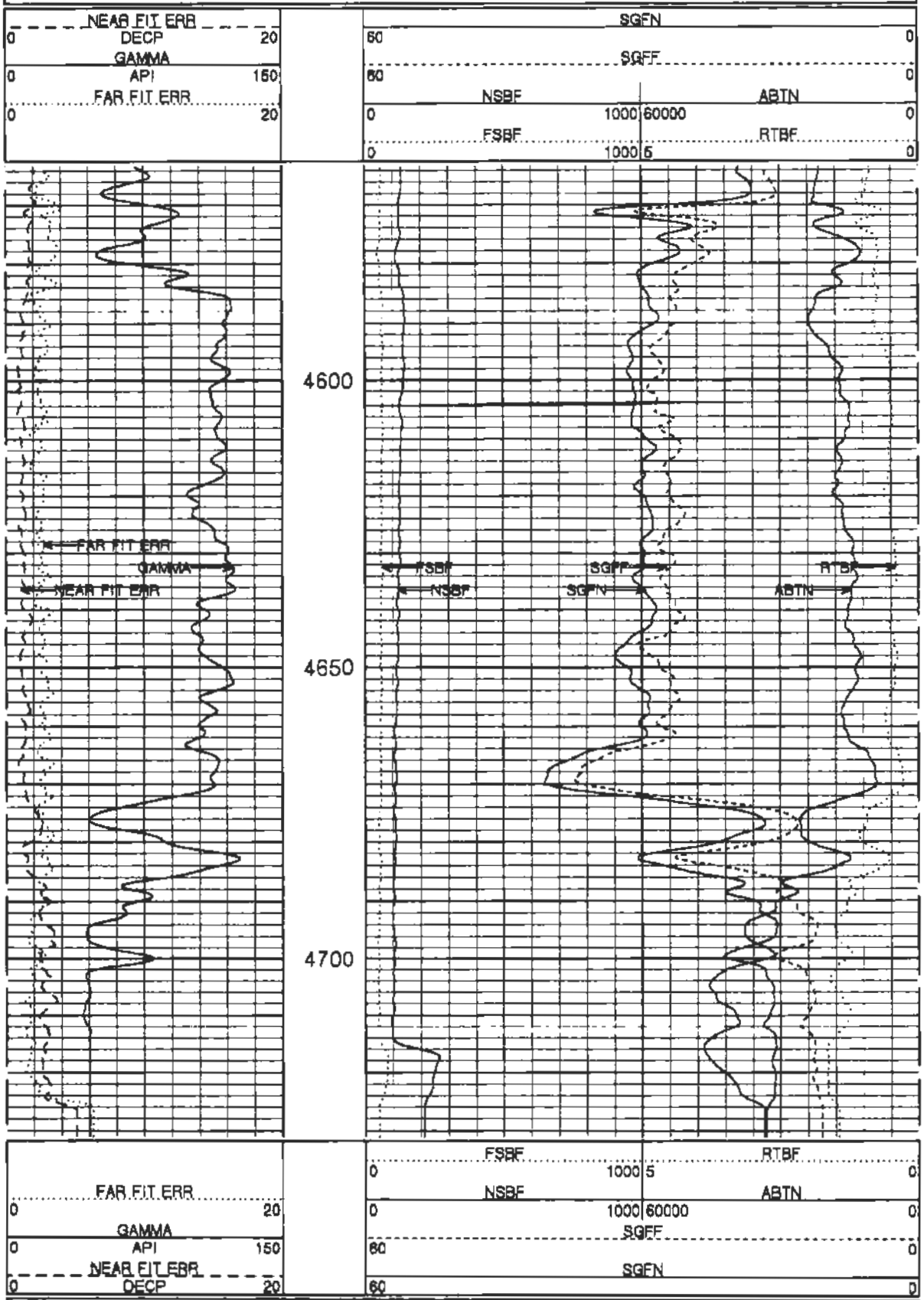
HALLIBURTON

Data File: 0908_1540_r0501.2.dls
Control File: plot_01_1.spc
Raster File: 0908_1540_r0501.plot_01_1
Bottom Depth: 4734.00
Database Time: 09-08-97 15:43:50

REPEAT SECTION QUALITY PRESENTATION

HALLIBURTON

Version No: 2.40 I hc:2.0
Data File: 0908_1540_r0501.1.dls
Control File: plot_01_1.spc
Raster File: 0908_1540_r0501.plot_01_1
Top Depth: 4582.75
Bottom Depth: 4731.00
Database Time: 09-08-97 15:41:25



Version No: 2.40 I hc:2.0
Top Depth: ——

Current EXCELL-2000 Parameter Values
Depth: 0.000
Date: 08-Mar-1997 15:39

Mnemonic	Tool	Parameter Description	Value	Units
PERF	TTTCHD	PERFORATED INTERVAL	NO	
CCLSEL	CCL_TT	CCL PROCESSING SELECTION	RAW	
CCLOFS	CCL_TT	CCL PERFORATION OFFSET	0	
GR_OK	GR_TT	DO GAMMA CALCULATIONS	YES	
CASED	GR_TT	IS THIS A CASED HOLE	YES	
CASEOD	SHARED	CASING DIAMETER (OD)	5.5	Inches
CASEWT	GR_TT	CASING WEIGHT	15.	Pounds/Ft.
CASCEM	GR_TT	CASING IN CEMENT?	YES	
CEMWT	GR_TT	CEMENT WEIGHT	15.	Pounds/Gal.
MUDWT	GR_TT	BOREHOLE FLUID WEIGHT	8.3	Pounds/Gal.
GRSO	GR_TT	GAMMA RAY STANDOFF	0.	Inches
BS	SHARED	BIT SIZE	7.875	Inches
TMDLOK	TMDL	DO TMDL CALCULATIONS?	YES	
SENS	TMDL	TMDL SENSITIVITY	1.612954	
CSF	TMDL	AIR FILLED BOREHOLE ?	NO	
BORSAL	TMDL	BORE HOLE SALINITY KPPM	0.2	KPPM
LTH	TMDL	DESIRED LITHOLOGY	SAND	
ICCM	TMDL	CEMENT SALINITY > 40 KPPM?	NO	
REST	TMDL	RESOLVING TIME (DEAD TIME)	1.231889	
GENSD	TMDL	GENERATOR SAFE DEPTH	100.	FT

EXCELL-2000 Calibration Report
Date: 08-Mar-1997 15:39

NATURAL GAMMA - TTTC SHOP CALIBRATION SUMMARY

PERFORMED: 28-Feb-1997 15:59 LAST SHOP CALIBRATION: 28-Feb-1997 15:56
SERIAL NUMBER: B017 MODEL: GR_TT
TRUCK UNIT NUMBER: PROGRAM VERSION: 2.40
PERFORMED BY: G. ROUSSEAU

	MEASURED	CALIBRATED	UNITS
BACKGROUND	31	31	GAPI
BACKGROUND+CALIBRATOR	282	282	GAPI
CALIBRATOR	252	251	GAPI
GAPI CONVERSION FACTOR	0.814		GAPI/CPS

THERMAL MULTIGATE DECAY LITH SHOP CALIBRATION SUMMARY

PERFORMED: 28-Feb-1997 15:22 LAST SHOP CALIBRATION: 03-Nov-1996 13:59
SERIAL NUMBER: A015 MODEL: TMDL
TRUCK UNIT NUMBER: PROGRAM VERSION: 2.40
PERFORMED BY: G. ROUSSEAU

RESULT	LOGGED	EXPECTED VALUE	DIFF.	TOL.	UNITS
SENSITIVITY	1.61	1.65	0.04	+/-0.15	
NEAR SPACED CNT	12829.9	10000-15000			CPS
FAR SPACED CNT	4018.3	3000-5000			CPS
SIGMA FORM NEAR	24.19	24.00	-0.19	+/-0.50	C.U.
SIGMA BORE NEAR	85.73	82.00	-3.73	+/-5.00	C.U.
SIGMA FORM FAR	22.68	23.00	0.32	+/-1.00	C.U.
RATIO NEAR/FAR	3.19	3.10	-0.09	+/-0.45	
CORR FORM SIGMA	21.874	21.70	-0.17	+/-0.50	C.U.
RATIO BORE/FORM	0.23	0.25	0.02	+/-0.05	C.U.
NEAR ERROR	0.87	<5.0			
FAR ERROR	0.65	<5.0			
NEAR BACKGROUND	239.01	<1000			
FAR BACKGROUND	59.38	<1000			
RESOLVING TIME	1.232	0.0 - 2.0			

2DIL1

DUAL INDUCTION-SFL

CSU

COMPANY: SIERRA RESOURCES, INC.

WELL: "PIACENTINE" #1-27

FIELD: R. KING ISLAND

COUNTY: SAN JOAQUIN

STATE: CALIFORNIA

NATION: U.S.A.

LOCATION: 3490'N AND 990'E FROM SOUTHWEST CORNER

SEC: 27 TWP: 3N RGE: 5E

DIVISION OF OIL AND GAS
RECEIVED
SEP 15 1986
WOODLAND, CALIFORNIA

OTHER SERVICES-
BHC
LDT-CML-GR

PERMANENT DATUM: GL
ELEV. OF PERM. DATUM: 6.5 F
LOG MEASURED FROM: KB
12.0 F ABOVE PERM. DATUM
DRLG. MEASURED FROM: KB

ELEVATIONS- 665
KB: [illegible] F
DF: 17.5 F
GL: [illegible] F
-6.5

PROGRAM
TAPE NO:
28.2A
SERVICE
ORDER NO:
524187

DATE: 8 JUL 86
RUN NO: 1

API SERIAL NO:
077-20484

DEPTH-DRILLER: 4900.0 F
DEPTH-LOGGER: 4900.0 F
BTM. LOG INTERVAL: 4894.0 F
TOP LOG INTERVAL: 628.0 F

077 20484

CASING-DRILLER: 627.0 F
CASING-LOGGER: 628.0 F
CASING: 8 5/8"
WEIGHT:
BIT SIZE: 7 7/8"
DEPTH: 4900.0 F

TYPE FLUID IN HOLE:	CYPAN	
DENSITY:	9.60 LB/G	
VISCOSITY:	37.0 S	
PH:	8.5	
FLUID LOSS:	6.4 C3	
SOURCE OF SAMPLE:	FLOWLINE	
RM:	3.960 OHMM AT 92.0	DEGF
RMF:	5.520 OHMM AT 66.0	DEGF
RMC:	4.590 OHMM AT 66.0	DEGF
SOURCE RMF/RMC:	MEASURED/MEASURED	
RM AT BHT:	3.087 OHMM AT 120.	DEGF
RMF AT BHT:	3.173 OHMM AT 120.	DEGF
RMC AT BHT:	2.638 OHMM AT 120.	DEGF
TIME CIRC. STOPPED:	19:30 7-7	
TIME LOGGER ON BTM.:	23:23 7-7	
MAX. REC. TEMP:	120.0	DEGF
LOGGING UNIT NO:	8126	
LOGGING UNIT LOC:	SACRAMENTO	

WITNESSED BY: TASKER

REMARKS:

INDUCTION AND SONIC RUN IN COMBINATION.
MUD CONTAINS 500 PPM CHLORIDES.
1.5" STAND-OFF AND CME-Z USED FOR CENTRALIZATION.

EQUIPMENT NUMBERS-

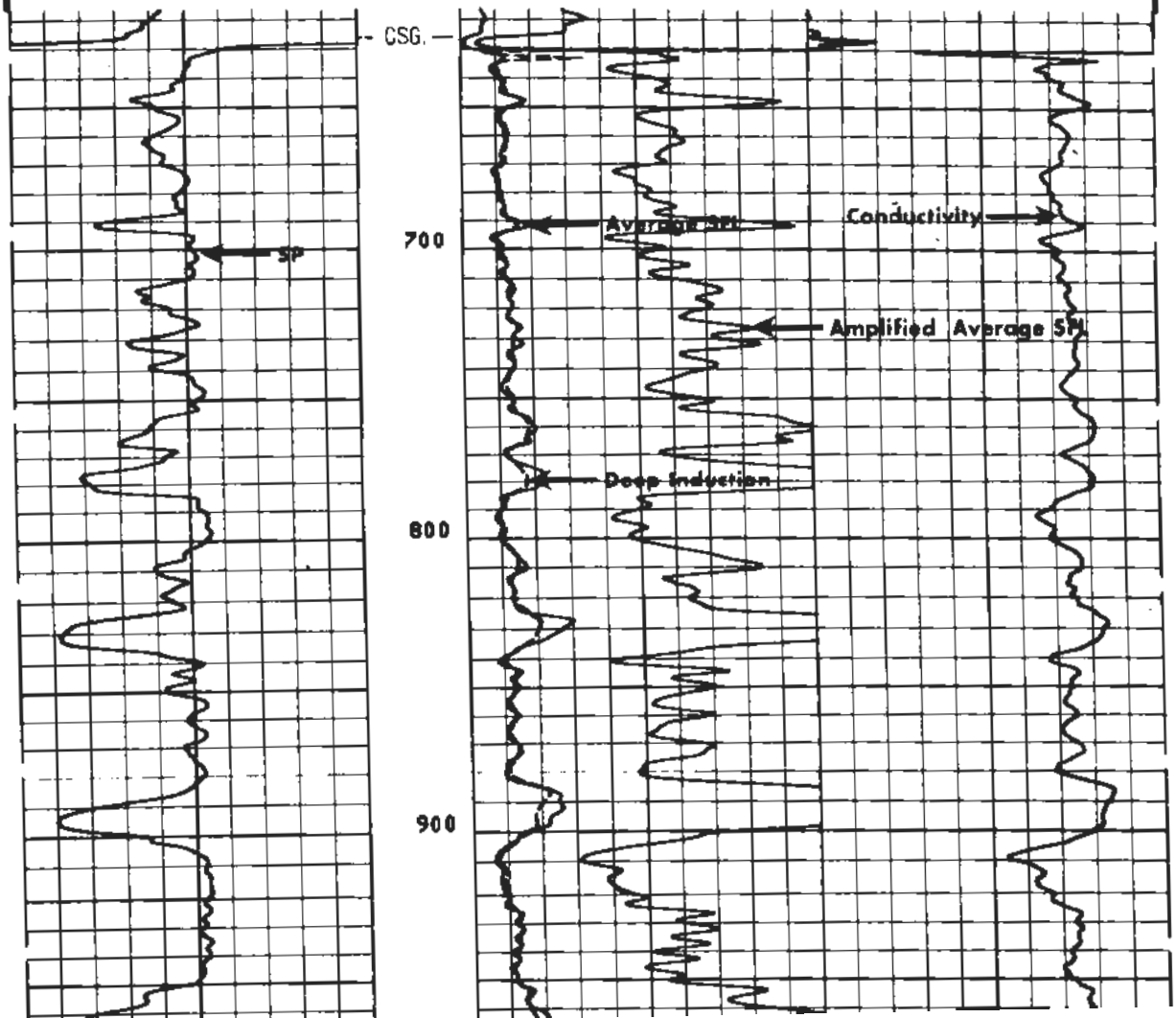
DIS-EC 1422	DIC-DA 1149	MCD-D 1106	SLS-RC 252
SLC-FA 1259	SGC-JAA 466	IEM-BD 232	SLM-DA 428
MLM-BC 456			

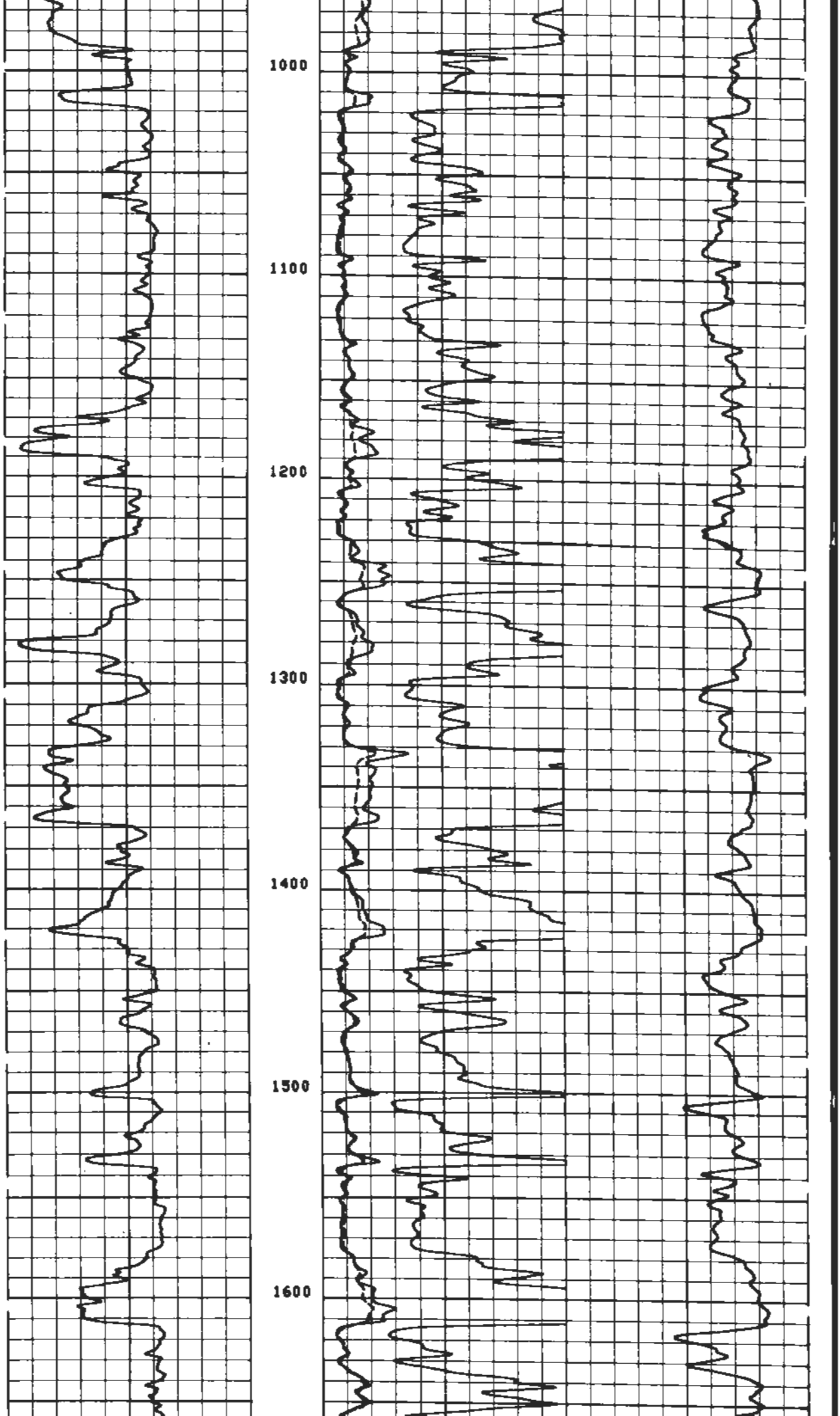
ALL INTERPRETATIONS ARE OPINIONS BASED ON INFERENCES FROM ELECTRICAL OR OTHER MEASUREMENTS AND WE CANNOT, AND DO NOT GUARANTEE THE ACCURACY OR CORRECTNESS OF ANY INTERPRETATIONS, AND WE SHALL NOT, EXCEPT IN THE CASE OF GROSS OR WILLFUL NEGLIGENCE ON OUR PART, BE LIABLE OR RESPONSIBLE FOR ANY LOSS, COSTS, 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 AS SET OUT IN OUR CURRENT PRICE SCHEDULE.

CP 28.2A FILE 3 08-JUL-86 00:48
DATA ACQUIRED 08-JUL-86 00:35

SP (MV)		ILD (OHMM)	CILD(MMHO)
		0.0 30.000	
		SFLA(OHMM) 0.0 6.0000	
SP (MV)		SFLA(OHMM)	CILD(MMHO)
-100.0 0.0		0.0 30.000	1000.0 0.0

CP 28.2A FILE 3 08-JUL-86 00:48
DATA ACQUIRED 08-JUL-86 00:35

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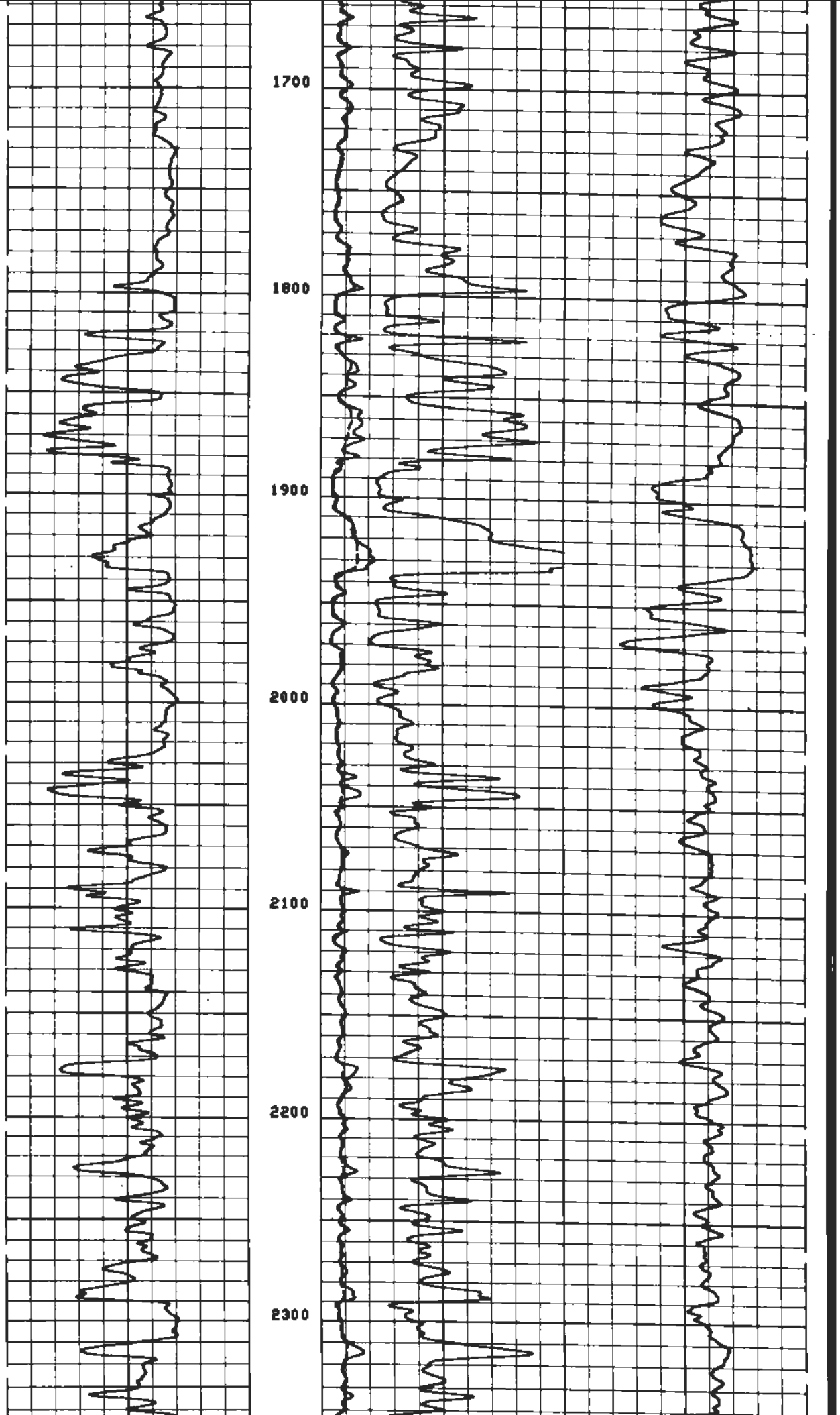
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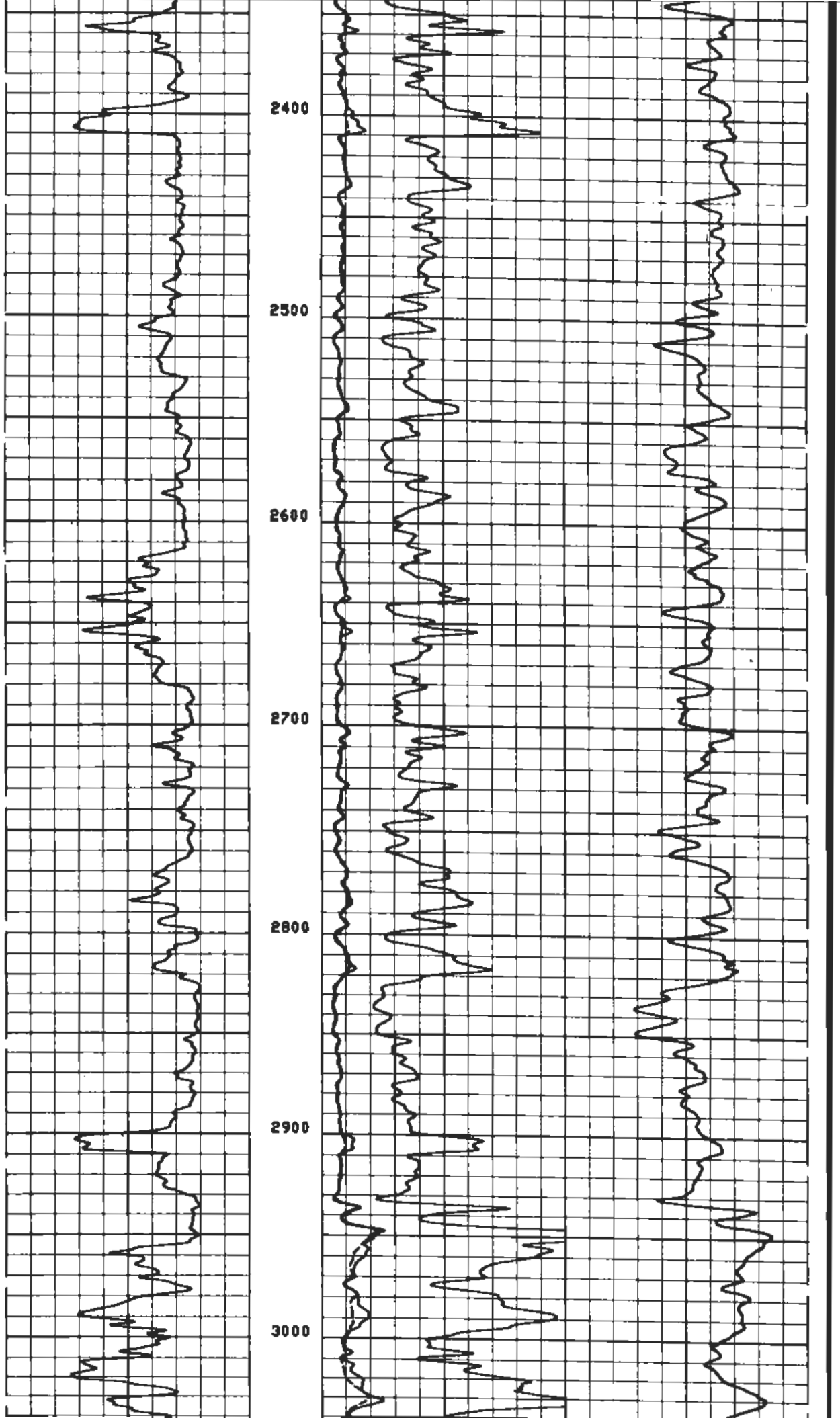
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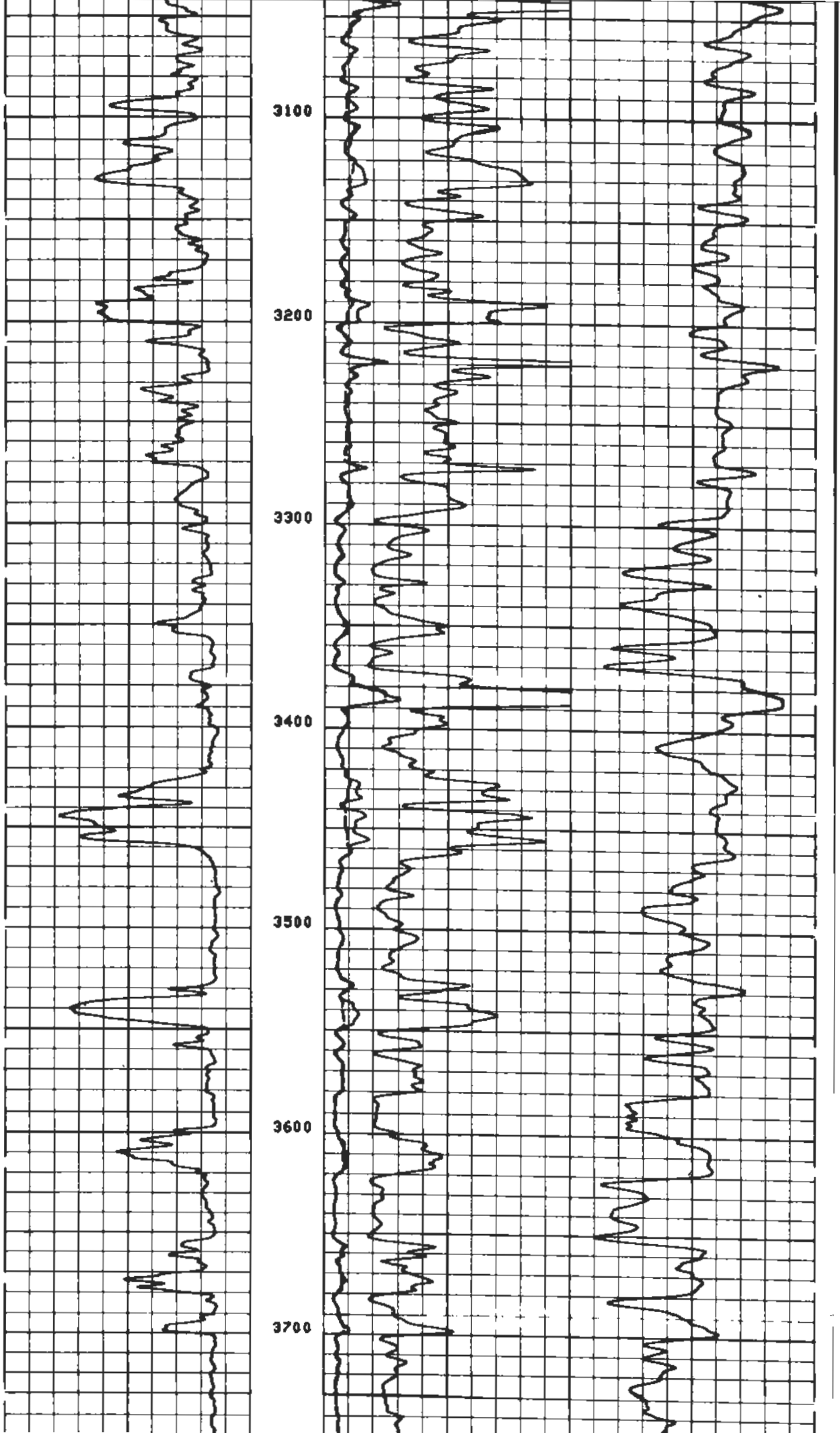
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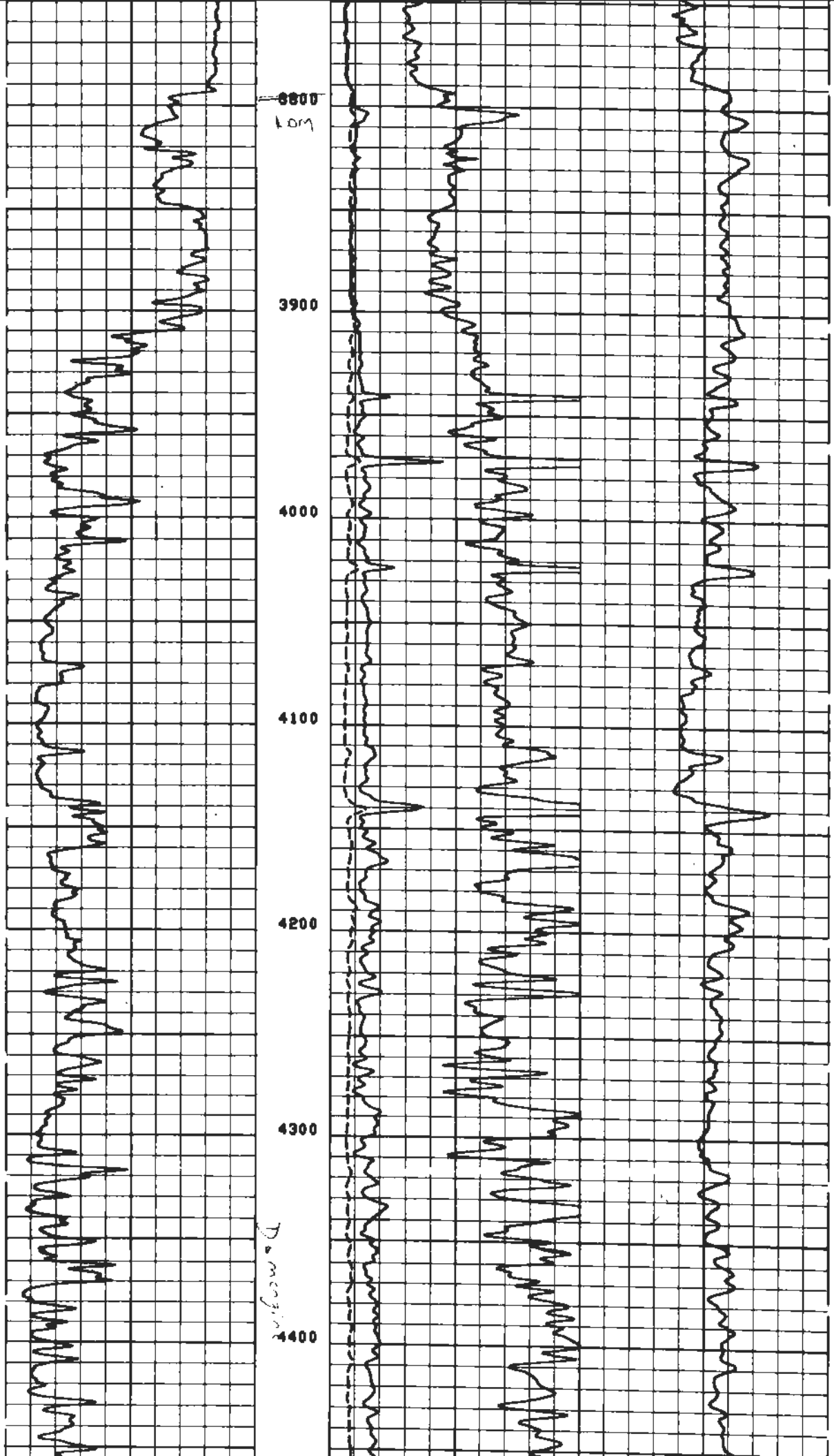
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TOM
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4000
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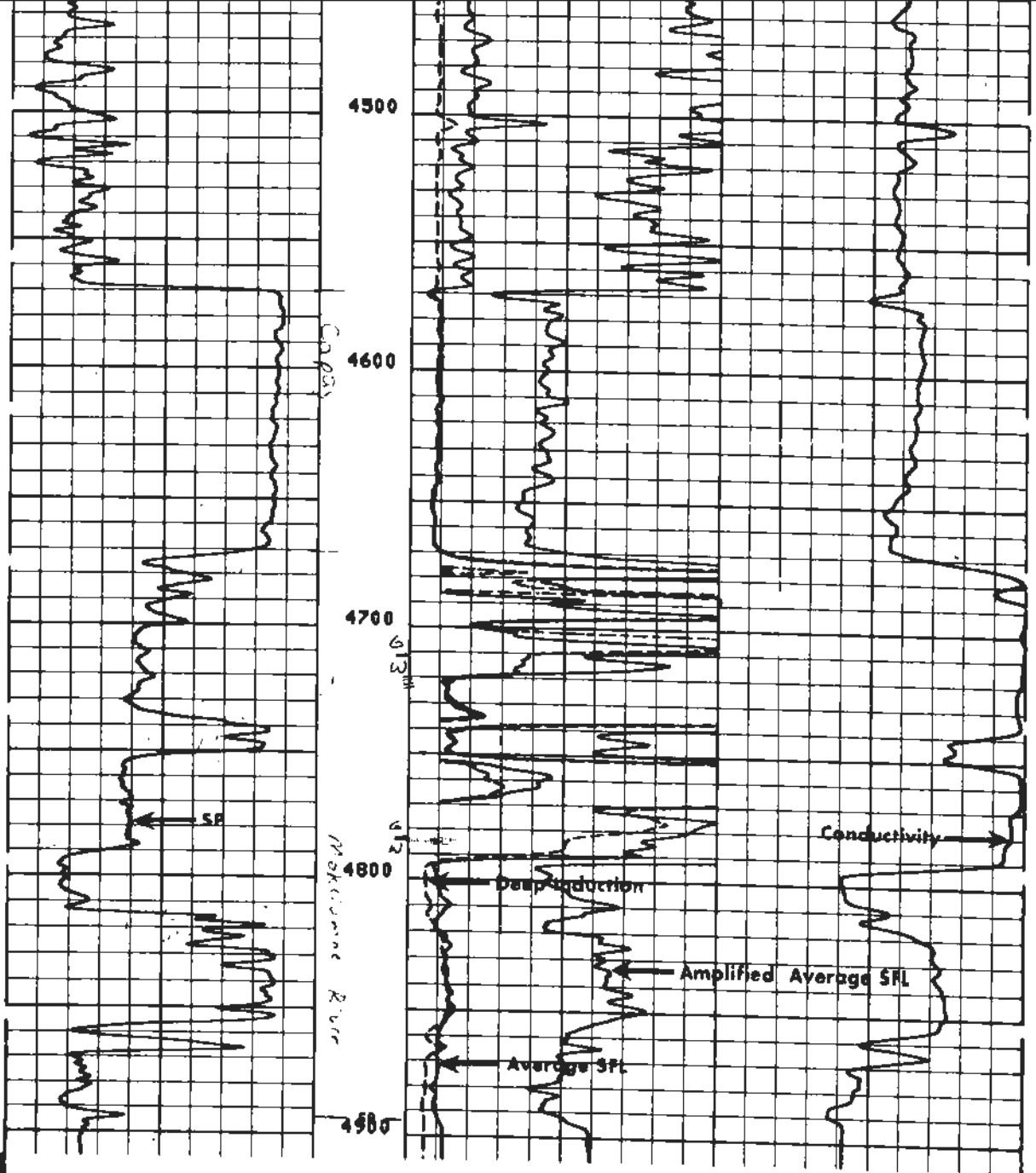
4200
4300
4400



CP 28.2A

FILE 3 08-JUL-86 00141
DATA ACQUIRED 07-JUL-86 23:22

SP (MV)		ILD (OHMM)	SFLA(OHMM)	SFLA(OHMM)	CILD(MMHO)
-100.0 0.0		0.0 30.000	0.0 6.0000	0.0 30.000	1000.0 0.0

SENSOR MEASURE POINT TO TOOL ZERO

SRAT	41.4	FEET	AMPL	43.9	FEET
TT1	42.9	FEET	CBL	43.9	FEET
TT3	40.2	FEET	TT2	43.9	FEET
TO	43.9	FEET	TT4	39.2	FEET
SLTT	43.9	FEET	TT	43.9	FEET
GR	64.1	FEET	SCBL	43.9	FEET
ILD	9.4	FEET	CALI	31.8	FEET
SFL	6.4	FEET	ILM	5.8	FEET
SPAR	2.5	FEET	SP	2.5	FEET
MOIS	2.5	FEET	TENS	2.5	FEET

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

REPORT OF PROPERTY AND WELL TRANSFER

Field or County **King Island Gas (San Joaquin Co.)**		District **District 6**
Former owner **Sierra Resources, Inc.**	Operator code **S3525**	Date **December 9, 2004**

Name and location of well(s)
"Piacentine" 1-27 (077-20484)
27/3N/5E

Description of the land upon which the well(s) is (are) located
See attachment A.

Date of transfer, sale, assignment, conveyance, or exchange **12/1/04**	New owner **Princeton Natural Gas**	Operator code **P4675**	Type of organization
	Address **34184 Pacific Coast Highway, Ste. C** **Dana Point, CA 92629**		Telephone No. **(858) 775-9897**

Reported by
Robert D. Eberts, President, Sierra Resources, Inc.

Confirmed by
Pat Ross, President, Princeton Natural Gas, LLC.

New operator new status (status abbreviation) **PA**	Request designation of agent **Pat Ross** **34184 Pacific Coast Highway, Ste. C** **Dana Point, CA 92629**
Old operator new status (status abbreviation) **PA**	Remarks

Deputy Supervisor
Robert S. Habel

Signature
Robert S Habel

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
AB – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book	RSH	12-10-04
Form OGD140			Notice to be cancelled	—	
New well cards	—		Bond status	RSH	12-10-04
Well records			EDP files	RSH	12-10-04
Electric logs			Computer Files	RSH	12-10-04
Production reports	—				

OGD156 (5/98)

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to:

Division of Oil, Gas, and Geothermal Resources
801 "K" Street, 20th Floor - MS 22
Sacramento, CA 95814-3530

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 0 1 2004
Sacramento, California

11/15/04
(date)

Effective date of transfer / acquisition 12/01/04 *(date)*, date of possession 12/01/04 *(if different)*,

Sierra Resources, Inc. *(old operator)*, transferred

the following wells to Princeton Natural Gas LLC *(new operator)*

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec.	T.	R.	API Number
Piacentine #1-27 Well (Including all associated surface & downhole equipment)	King Island Field San Joaquin Co.	27	3N	5E	04-077-20484

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: See attached Exhibit "A"

OLD OPERATOR

Sierra Resources, Inc. (SRSTMS) *(operator name)*

P.O. Box 2788 *(address)*

Mammoth Lakes, CA 93546

Phone (760) 934-3356

By Robert D Eberts *(signature)* 11/15/04 *(date)*

Robert D. Eberts *(printed name)* President *(title)*

NEW OPERATOR

Princeton Natural Gas LLC (P4075) *(operator name)*

34184 Pacific Coast Highway, Suite C *(address)*

Dana Point, CA 92629

Phone (858) 775-9894

By *(signature)* 11/24/04 *(date)*

Pat Ross *(printed name)* President *(title)*

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

Exhibit "A"

LEASE NUMBER:	29955-00
LESSOR:	PIACENTINE, FRED, A WIDOWER
LESSEE:	TENNECO OIL COMPANY
EFFECTIVE DATE:	DECEMBER 7, 1983
RECORDED SAN JOAQUIN CO.:	INSTRUMENT #83-88905, AMENDED BY INSTRUMENT #86-65563
LEASE DESCRIPTION:	T-3-N, R-5-E: PARCEL 1: THAT PORTION OF SECTIONS 27, 28, 29, 32, 33 AND 34, ALSO REFERRED TO AS KING ISLAND DESCRIBED AS FOLLOWS: COMMENCING AT A POINT NEAR THE WEST END OF THE HIGHWAY BRIDGE CROSSING BISHOP CUT, SAID POINT BEING MARKED BY A RAILROAD SPIKE, STAMPED R. E. 2909, DRIVEN INTO THE PAVEMENT OF THE G. A. ATHERTON ROAD NO. 550, SAID POINT OF COMMENCEMENT BEING SOUTH 88° 23' 30" WEST, 14,048.79 FEET, MORE OR LESS, FROM THE SOUTHEAST CORNER OF SECTION 36, TOWNSHIP 3 NORTH, RANGE 5 EAST, M.D.B.&M; THENCE RUNNING FROM POINT TO POINT ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 14' WEST, 1,796.64 FEET; NORTH 1° 57' WEST, 389.90 FEET; NORTH 0° 43' WEST, 479.10 FEET TO THE POINT OF BEGINNING SAID POINT OF BEGINNING BEING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 43' WEST, 2,351.90 FEET; NORTH 8° 47' EAST, 144.75 FEET; NORTH 25° 03' EAST, 425.71 FEET, MORE OR LESS, TO A POINT LYING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE EXISTING DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE EXISTING DRAINAGE DITCH, SOUTH 88° 18' 10" WEST, 1,823.99 FEET MORE OR LESS, TO THE POINT OF INTERSECTION WITH THE CENTERLINE OF THE DRAINAGE CANAL RUNNING IN A WESTERLY DIRECTION; THENCE RUNNING ALONG THE CENTERLINE OF THE "WESTERLY" DRAINAGE CANAL, SOUTH 89° 15' WEST, 6,153.62 FEET TO THE POINT OF INTERSECTION OF THREE PRESENT DRAINAGE CANALS; THENCE RUNNING IN A SOUTHERLY DIRECTION ALONG THE CENTERLINE OF A PRESENT DRAINAGE CANAL, SOUTH 0° 43-1/2' EAST, 2,758.54 FEET TO THE POINT OF INTERSECTION WITH THE PROLONGED CENTERLINE OF A PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE PRESENT DRAINAGE DITCH, NORTH 89° 54-1/2' EAST, 7,708.46 FEET TO THE POINT OF BEGINNING. PARCEL 2: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL 1 AND THE OUTER TOE OF THE LEVEE, AS SAID LEVEE IS DESCRIBED IN PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS. PARCEL 3: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS (THE OUTER TOE OF THE LEVEE ON THE WEST SIDE OF BISHOP CUT), AND A LINE PARALLEL TO AND 200 FEET EASTERLY FROM THE SAID EASTERLY BOUNDARY OF PARCEL 2. SAID PARCELS OF SAID LEASE HEREIN REFERRED TO, CONSTITUTE ALL OF THE LAND CONVEYED TO FRED PIACENTINI BY DEEDS RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS.

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 0 1 2004
Sacramento, California

REPORT OF PROPERTY/WELL TRANSFER OR ACQUISITION

(To be completed by old and new operators)

Please complete and return this form to:

11/15/04
(date)

Division of Oil, Gas, and Geothermal Resources
801 "K" Street, 20th Floor - MS 22
Sacramento, CA 95814-3530

Effective date of transfer / acquisition 12/01/04 *(date)*, date of possession 12/01/04 *(if different)*,

Sierra Resources, Inc. *(old operator)*, transferred

the following wells to Princeton Natural Gas LLC *(new operator)*

NOTE: Pursuant to Section 3202 of the Public Resources Code, before wells will be transferred, the new operator must provide proper bond coverage and well information for all transferred active, idle, and/or plugged and abandoned wells.

Well Designation	Field or County	Sec.	T.	R.	API Number
Piacentine #1-27 Well (Including all associated surface & downhole equipment)	King Island Field San Joaquin Co.	27	3N	5E	04-077-20484

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 0 1 2004
Sacramento, California

(If additional space is needed, use separate sheets.)

Legal description of the land where the well(s) is (are) located: See attached Exhibit "A"

OLD OPERATOR

Sierra Resources, Inc.
(operator name)

P.O. Box 2788
(address)

Mammoth Lakes, CA 93546

Phone (760) 934-3356

By [signature] 11/15/04
(signature) *(date)*

Robert D. Eberts President
(printed name) *(title)*

NEW OPERATOR

Princeton Natural Gas LLC
(operator name)

34184 Pacific Coast Highway, Suite C
(address)

Dana Point, CA 92629

Phone (858) 775-9891

By [signature] 11/24/04
(signature) *(date)*

Pat Ross President
(printed name) *(title)*

Note: By signing this form, both the old operator and the new operator certify that the new operator owns the mineral interest, holds a valid and effective lease, or holds a valid and effective operating contract, giving the new operator the right to operate the well or wells being transferred.

Exhibit "A"

LEASE NUMBER:	29955-00
LESSOR:	PIACENTINE, FRED, A WIDOWER
LESSEE:	TENNECO OIL COMPANY
EFFECTIVE DATE:	DECEMBER 7, 1983
RECORDED SAN JOAQUIN CO.:	INSTRUMENT #83-88305, AMENDED BY INSTRUMENT #86-65563
LEASE DESCRIPTION:	T-3-N, R-5-E: PARCEL 1: THAT PORTION OF SECTIONS 27, 28, 29, 32, 33 AND 34, ALSO REFERRED TO AS KING ISLAND DESCRIBED AS FOLLOWS: COMMENCING AT A POINT NEAR THE WEST END OF THE HIGHWAY BRIDGE CROSSING BISHOP CUT, SAID POINT BEING MARKED BY A RAILROAD SPIKE, STAMPED R. E. 2909, DRIVEN INTO THE PAVEMENT OF THE G. A. ATHERTON ROAD NO. 550, SAID POINT OF COMMENCEMENT BEING SOUTH 88° 23' 30" WEST, 14,048.79 FEET, MORE OR LESS, FROM THE SOUTHEAST CORNER OF SECTION 36, TOWNSHIP 3 NORTH, RANGE 5 EAST, M.D.B.&M; THENCE RUNNING FROM POINT TO POINT ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 14' WEST, 1,796.64 FEET; NORTH 1° 57' WEST, 389.90 FEET; NORTH 0° 43' WEST, 479.10 FEET TO THE POINT OF BEGINNING SAID POINT OF BEGINNING BEING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE CROWN OF THE LEVEE THE FOLLOWING COURSES AND DISTANCES; NORTH 0° 43' WEST, 2,351.90 FEET; NORTH 8° 47' EAST, 144.75 FEET; NORTH 25° 03' EAST, 425.71 FEET, MORE OR LESS, TO A POINT LYING ON THE EASTERLY PROLONGATION OF THE CENTERLINE OF THE EXISTING DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE EXISTING DRAINAGE DITCH, SOUTH 88° 18' 10" WEST, 1,823.99 FEET MORE OR LESS, TO THE POINT OF INTERSECTION WITH THE CENTERLINE OF THE DRAINAGE CANAL RUNNING IN A WESTERLY DIRECTION; THENCE RUNNING ALONG THE CENTERLINE OF THE "WESTERLY" DRAINAGE CANAL, SOUTH 89° 15' WEST, 6,153.62 FEET TO THE POINT OF INTERSECTION OF THREE PRESENT DRAINAGE CANALS; THENCE RUNNING IN A SOUTHERLY DIRECTION ALONG THE CENTERLINE OF A PRESENT DRAINAGE CANAL, SOUTH 0° 43-1/2' EAST, 2,758.54 FEET TO THE POINT OF INTERSECTION WITH THE PROLONGED CENTERLINE OF A PRESENT DRAINAGE DITCH; THENCE RUNNING ALONG THE PROLONGED CENTERLINE OF THE PRESENT DRAINAGE DITCH, NORTH 89° 54-1/2' EAST, 7,708.46 FEET TO THE POINT OF BEGINNING. PARCEL 2: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL 1 AND THE OUTER TOE OF THE LEVEE, AS SAID LEVEE IS DESCRIBED IN PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS. PARCEL 3: A STRIP OF LAND LYING BETWEEN THE EASTERLY BOUNDARY OF PARCEL II IN THE DEED TO EDWARD H. PIACENTINI, ET AL, RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND IN THE DEED TO FRED PIACENTINI, ET UX, AS WAS RECORDED MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS (THE OUTER TOE OF THE LEVEE ON THE WEST SIDE OF BISHOP CUT), AND A LINE PARALLEL TO AND 200 FEET EASTERLY FROM THE SAID EASTERLY BOUNDARY OF PARCEL 2. SAID PARCELS OF SAID LEASE HEREIN REFERRED TO, CONSTITUTE ALL OF THE LAND CONVEYED TO FRED PIACENTINI BY DEEDS RECORDED JANUARY 7, 1947, IN BOOK 1033, PAGE 178, OFFICIAL RECORDS, AND MARCH 10, 1952, IN BOOK 1401, PAGE 92, OFFICIAL RECORDS.

Div. of Oil & Gas - Dist. 6
RECEIVED
DEC 0 1 2004
Sacramento, California

DISTRICT 6—WELL RECORDS CHECK LIST

COMPANY: _____ WELL NO.: _____

API: 077 20484 NOTICE FOR : ☐ drill ☐ rd ☒ rw ☐ abd

P-date(s) _____

RECORDS RECEIVED

	DATE	OK	Copies to IHS	NEEDS	NORD	REMARKS
Well Summary (OG100)..						
History (OG103)	[illegible]					
Directional Survey.....						
E-logs (2").....						
E-logs (5").....						
MUD Logs.....						
CBL.....						
Other_____						

☐ CONFIDENTIAL
RELEASE DATE_____

Bond Release _____ **Date**_____

STATUS

Producing—Oil	____	Water Disposal	____
Idle—Oil	____	Waterflood	____
Abandoned-Oil	____	Steamflood	____
Drilling—Idle	____	Fire Flood	____
Abandoned-Dry hole	____	Air Injection	____
Producing—Gas	____	Gas Injection	____
Idle—Gas	____	CO2 Injection	____
Abandoned-Gas	____	LPG Injection	____
Gas—Open to Oil Zone	____	Observation	____
Gas Storage	____	Waterflood Source	____

DATE _____

REMARKS: _____

_____

ABANDONMENTS

Map Made for Surface Inspection _____

☐ **Surface Inspection** NEEDED
Completed_____

☐ **Final Letter** NEEDED
Completed_____

3/1/02

MAP # _____ BY:_____ DATE _____

DATABASE BY:_____ DATE _____

RECORDS APPROVED

BY: _____ **DATE** _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.
2 Hidden Lake Circle
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637
e-mail: sri@qnet.com

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 1/17/02

RECOMPLETION HISTORY

DATE	REMARKS
11/28/01	Found well flowing to sales line. Shut in well with 550 psi FTP. R/U Halliburton wireline and ran in hole with 1-11/16" 6 SPF "wide angle" deep star gun and perforated 4676 - 4682' DIL with no change in well pressure. POOH and rig down Halliburton wireline unit. Left well shut in for buildup pressure.
11/29/01	Opened well - 700 psi on tubing and casing. Returned well to production with no change in production. Zone very tight with limited flow potential -- evaluating abandonment due to break even economics at current gas prices.

Div. of Oil & Gas - Dist. 6
RECEIVED
JAN 23 2002
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 601-577

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
05 (new pool code)
05 (old pool code)

Mr. Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
P.O. Box 2788
Mammoth Lakes, CA 93546-2788

Sacramento, California
November 26, 2001

Your _____ proposal to Rework well "Piacentine" 1-27
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B.&M.
King Island Gas field, any area Mokelumne pool
San Joaquin County, dated 11/10/2001, received 11/16/2001 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 3M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 3M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. **THIS DIVISION IS NOTIFIED**:
   a. In the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks, they shall be promptly reported to this district office.
   b. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   c. To inspect the installed blowout prevention equipment prior to commencing operations.

Blanket Bond
BW/jc
Enc(2)

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor
By Robert S. Habel
Robert S. Habel, *Deputy Supervisor*

Engineer Bill Winkler
Phone (916) 322-1110

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

"Piacentine" 1-27
API 077-20484

BW – 11/26/2001
Well Class - OG

5-1/2", 15.5#, K55

8-5/8", 24#, K55

BFW – 150'

627'

Hole: 12-1/4"

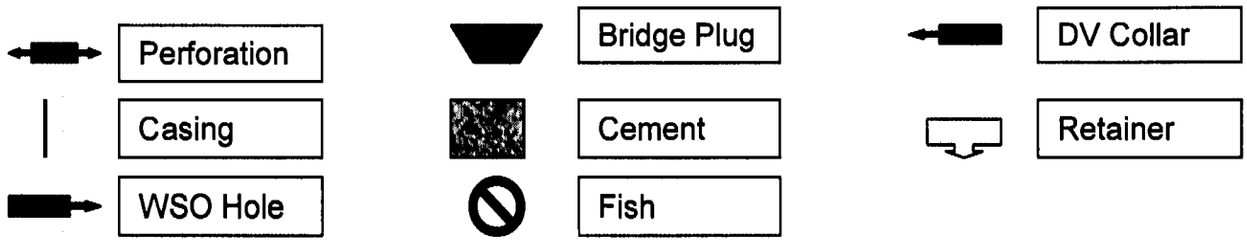
Hole: 7 7/8"

ETOC 3896'

4670'-4678'
4684'-4690' SQZD
4700'-4705' SQZD
BP 4715'
4720'-4724' SQZD
4750'-4764' SQZD

4900'

TD – 4900'



RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	P-577	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE # 1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., RIO BLANCO (KING ISLAND) Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD = 4715' (Bridge Plug)

2. Complete casing record, including plugs and perforations (present hole)
   8-5/8" 24# K-55 ST&C 8RD casing set at 627'.
   5-1/2" 15.5# K-55 LT&C 8RD casing set at 4900'.

   Perforations: 4750'- 4764' - squeezed 5/9/91.
   4720'- 4724' - squeezed 3/5/97.
   4700-4705' } - squeezed 3/8/01
   4684-4690' }

   4670 - 4678' - open & producing.

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted same

4. Present zone pressure ± 1000 psi ; New zone pressure ± 1200 psi

5. Last produced currently on production (Date) -0- (Oil, B/D) 22 BWPD (Water, B/D) 75 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) (Water, B/D) (Gas, Mcf/D) (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

As per the attached workover procedure.

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 16 2001
Sacramento, California

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address P.O. Box 2788 (Street)
Mammoth Lakes, CA 93546 (City) (State) (Zip)
Telephone Number (760) 934-3356
FAX (760) 934-5637

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name Printed)
Robert D. Eberts (Name - Signature) 11/10/01 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 16 2001
Sacramento, California

PIACENTINE #1-27 WELL
WORKOVER PROGRAM
NOVEMBER 10, 2001

WELL INFORMATION

API No: 04-077-20484 FIELD: King Island

ELEVATION: All measurements from KB (13' above GL)
(KB-THF = 11.5')

TD: 4900' PBTD: 4715' (bridge plug)

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 627'

5-1/2" 15.50#, K-55 LT&C csg. from surface to 4900' cemented with 150 sx (TOC @ 4175')

PACKER/TUBING: No packer
2-3/8" 4.7# J-55 8rd EUE tubing to 4587'

EXISTING PERFORATIONS: 4670' - 4678' DIL (open)

BOTTOM HOLE PRESSURE DATA: ± 1300 psi (current zone)

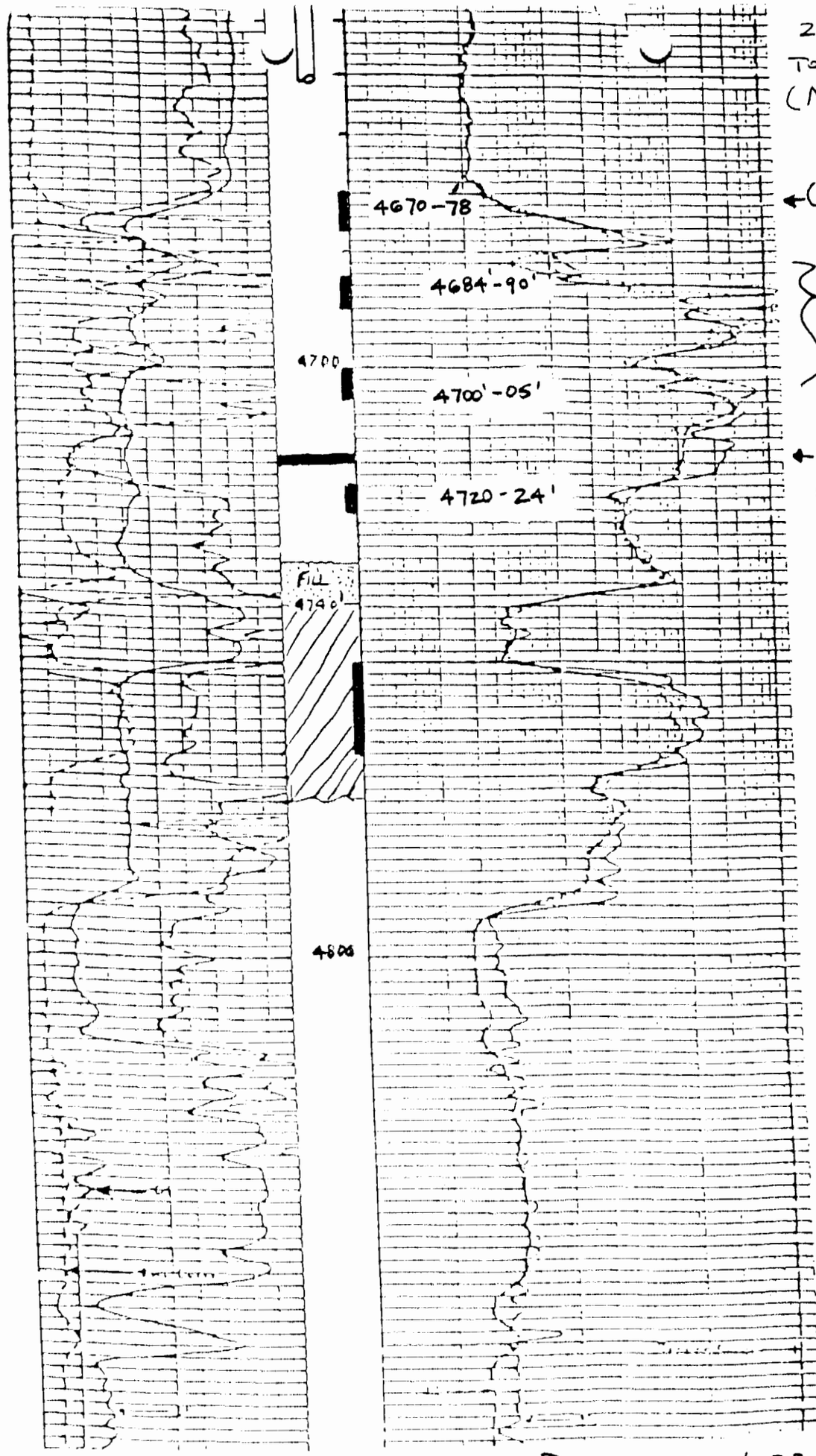
PROPOSED PERFORATIONS: Return to production in current zone with additional perforations 4678'- 4682' DIL

Note: existing perforations 4676'- 4678' DIL to be re-shot

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. R/U Halliburton wireline and test wireline lubricator. RIH with six (6) foot 1-11/16" Deep Star thru tubing perforating gun, configured @ 6 shots/ft & Tri-Phase phasing. Put gun on depth and perforate well from 4676'- 4682' DIL. POOH and R/D Halliburton wireline.
2. Return well to production, initially restricting flow rate to ± 250 mcf/day.



PIACENTINE 1-27 WELL
SIERRA RESOURCES, INC.

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 16 2001
Sacramento, California

SIERRA RESOURCES
INCORPORATED

FACSIMILE COVER SHEET

DATE: 11/12/01

TO: D.O.G.G.

FROM: Doug Eberts

TIME: 9:25 AM/PM

RE: PERMIT TO ADD PERFORATIONS PLACENTIA 1-27 WELL

PAGES: 4 INCLUDING THIS COVER SHEET

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CALL (760) 934-3356 AND ASK FOR JEANIE.

MESSAGE: ORIGINAL IN THE MAIL TO YOU.

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 15 2001
Sacramento, California

P.O. BOX 2788 • MAMMOTH LAKES, CA 93546-2788 • (760) 934-3356 • FAX (760) 934-5637

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. "Piacentine" 1-27

API No. 037-20484 Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	____	Water Disposal	____
Idle - Oil	____	Waterflood	____
Abandoned - Oil	____	Steamflood	____
Drilling - Idle	____	Fire Flood	____
Abandoned - Dry Hole	____	Air Injection	____
Producing - Gas	____	Gas Injection	____
Idle - Gas	____	CO_2 Injection	____
Abandoned - Gas	____	LPG Injection	____
Gas-Open to Oil Zone	____	Observation	____
Gas Storage	____	Waterflood Source	____

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED _____

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK _____

LONG BEACH OFFICE - USE REVERSE SIDE

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

WORK PERFORMED

Drill _____ Redrill _____ Deepen _____

Plug _____ Alter Casing _____

Waterflood _____ Water Disposal _____

Abandon _____

Other _____

STATUS **DATE**

Producing _____ "E" well Yes ☐ No ☐

Recompleted Producing _____

Waterflood _____

Water Disposal _____

Abandoned _____

Other _____

MAP AND BOOK _____ Engineer _____

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____

(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____

and

File cleared _____ OGD121 _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.
2 Hidden Lake Circle
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637
e-mail: sri@qnet.com

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 5/9/01

Div. of Oil & Gas - Dist. 3
RECEIVED
MAY 15 2001
Sacramento, California

RECOMPLETION HISTORY

DATE	REMARKS
3/7/01	MIRU rig. R/U on tree. Load well with lease water to kill same. Attempt to remove tubing hanger for two hours without success. Secured well for night.
3/8/01	Opened well - slight vacuum on tubing and casing. N/D tree, N/U and test BOP's. Ran in hole with 2-3/8" tubing to fill @ 4705'. Circulated hole clean to top of CIBP @ 4715'. R/U Halliburton and broke down formation with 650 psi @ 1-1/4 BPM. Mix and pump 25 sacks of neat cement. Equalize cement plug and POOH 350'. Bradenhead squeeze 15 cubic feet ft of cement into perforations 4684-4690' to a squeeze pressure of 2000 psi. Close in well under pressure and secured same for night.
3/10/01	Opened well & bled off pressure. RIH to top of cement @ 4520'. POOH and RIH with 4-3/4" bit and BHA. Rig up power swivel and drill hard cement to 4705'. Circulate clean to 4715'. Secured well for night.
3/11/01	POOH and lay down bit & BHA. RIH with open ended 2-3/8" tubing (drifting same) to 4715'. Land tubing on hanger with tubing tail @ 4587'. N/D BOPE and N/U tree. Rigged up swab line and swabbed fluid level down to 2000'. R/D and release rig. Secured well for night.
3/28/01	Opened well - dead. R/U Halliburton wireline and perforated 4670 - 4676' DIL with 1-11/16" zero degree phased Deep Star gun @ 6 SPF. Well would not unload. Secured well for night to wait on swabbing unit.
4/5/01	Opened well - 220 psi on tubing and casing. Rigged up swab unit, swabbed well in and returned well to production in new perforations. Zone very tight with limited flow potential.
4/11/01	R/U Halliburton wireline and re-perforated zone from 4670 to 4678' DIL with 1-11/16" tri-phased Deep Star gun @ 6 SPF. Returned well to production.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

No. P 601-084

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)

00 (area code)

00 (new pool code)

00 (old pool code)

Mr. Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
P.O. Box 2788
Mammoth Lakes, CA 93546-2788

Sacramento, California
February 27, 2001

Your _____ proposal to Rework well "Piacentine" 1-27
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B.&M.
King Island Gas field, any area Mokelumne pool
San Joaquin County, dated 02/16/2001, received 02/26/2001 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 3M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 3M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. **THIS DIVISION IS NOTIFIED**:
   a. In the event there are any blowouts, fires, serious accidents, or any significant gas or water leaks, they shall be promptly reported to this district office.
   b. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   c. To inspect the installed blowout prevention equipment prior to commencing operations.

Blanket Bond
BW/jc
Enc(2)

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

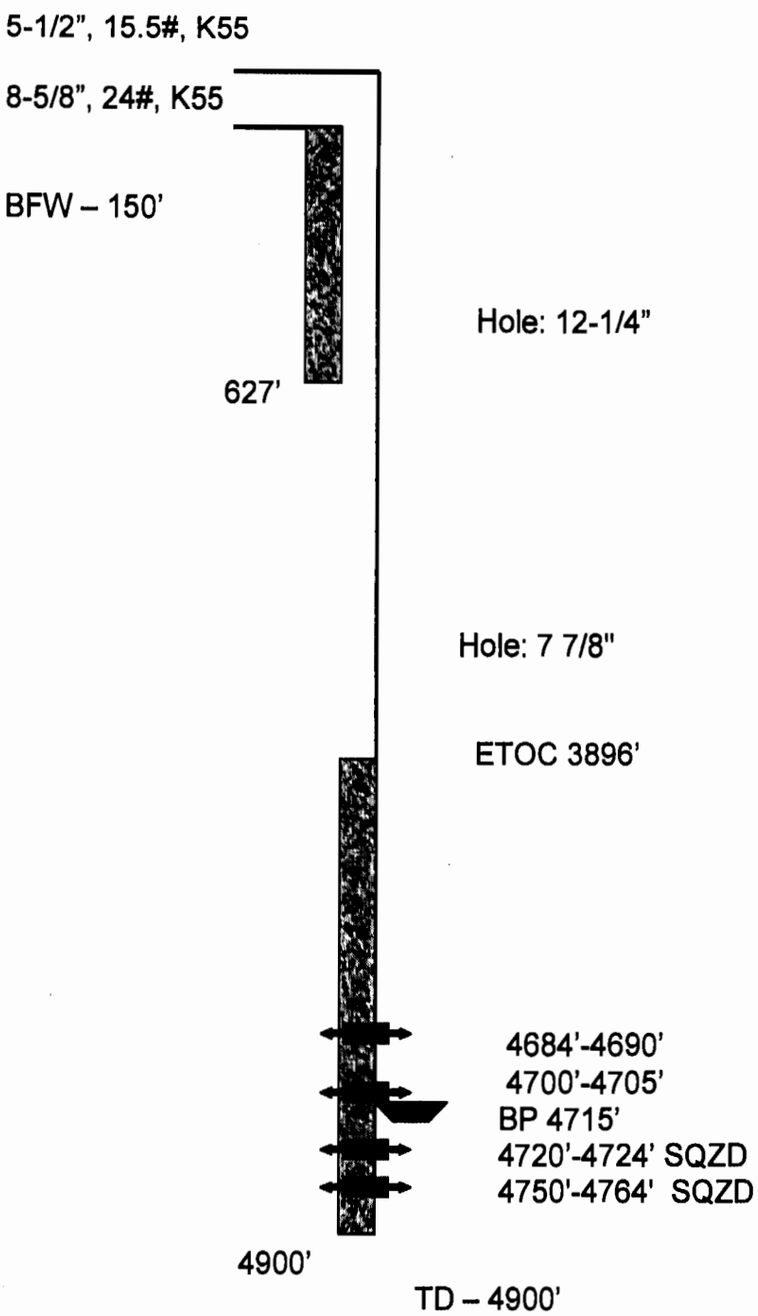
Engineer Bill Winkler
Phone (916) 322-1110

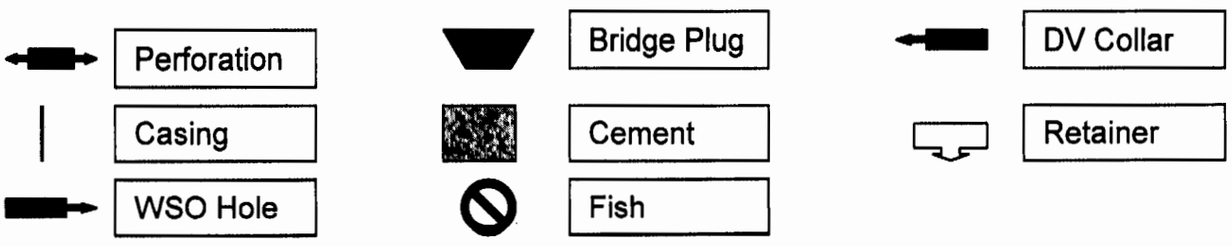
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (6/96/GSR/5M)

"Piacentine" 1-27
API 077-20484

Spud Date:
BW – 02/27/2001
Well Class - OG





Oil & Gas - Dist. 6
RECEIVED
FEB 26 2001
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD114	OGD121
BB	P-084	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE # 1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., ~~RIO BLANCO~~ Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD = 4715' (Bridge Plug)

2. Complete casing record, including plugs and perforations (present hole)
   8-5/8" 24# K-55 ST&C 8RD casing set at 627'.
   5-1/2" 15.5# K-55 LT&C 8RD casing set at 4900'.

   Perforations: 4750'- 4764' - squeezed 5/9/91.
   4720'- 4724' - squeezed 3/5/97.

   4700'- 4705' open & producing.
   & 4684 - 4690'

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted same

4. Present zone pressure ± 1200 psi ; New zone pressure ± 1200 psi

5. Last produced currently on production (Date) | -0- (Oil, B/D) | 15 BWPD (Water, B/D) | 50 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) | (Water, B/D) | (Gas, Mcf/D) | (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

AS PER ATTACHED WORKOVER PROCEDURE.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address P.O. Box 2788 (Street)
MAMMOTH LAKES, CA 93546 (City) (State) (Zip)
Telephone Number (760) 934-3356
FAX (") 934-5637

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name Printed)
Robert D Eberts 2/16/01 (Name - Signature) (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

Div. of Oil & Gas - Dist. 6
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Sacramento, California

PIACENTINE #1-27 WELL
REVISED WORKOVER PROGRAM
FEBRUARY 16, 2001

WELL INFORMATION

API No: 04-077-20484 FIELD: King Island

ELEVATION: All measurements from KB (13' above GL)
(KB-THF = 11.5')

TD: 4900' PBTD: 4715' (bridge plug)

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 627'

5-1/2" 15.50#, K-55 LT&C csg. from surface to 4900' cemented with 150 sx (TOC @ 4175')

PACKER/TUBING: No packer
2-3/8" 4.7# J-55 8rd EUE tubing to 4650'

EXISTING PERFORATIONS: 4684'- 4690' & 4700'- 4705' DIL (open)

BOTTOM HOLE PRESSURE DATA: ± 1100 psi (current zone)

PROPOSED PERFORATIONS: Return to production in current zone (4684'- 4690' upper perfs only)

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. MIRU rig. R/U on tree. Circulate well with lease water and kill same. N/D tree and N/U BOP's. Note: Send in tree to Cameron's Woodland shop to service same.

2. POOH slowly, keeping hole full and stand back tubing.

PIACENTINE #1-27 WELL
WORKOVER PROGRAM
FEBRUARY 16, 2001

Div. of Oil & Gas - Dist. 6
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3. Pick up additional tubing and RIH open ended with tubing string. Reverse circulate clean to top of bridge plug @ 4715'. R/U cementers and test lines and manifold to 3000 psi. Spot 200" cement plug and pull tubing to ± 4400'. Reverse circulate clean above cement plug.

4. Bradenhead squeeze perforations 4684'- 4690' & 4700'- 4705' to 1000 psi over initial injection pressure (do not exceed 2500 psi). POOH with tubing string and secure well for night.

5. Trip in hole with bit and BHA on tubing string. Tag cement and drill out same to top of bridge plug @ 4715'. Circulate clean and test perforations to 1000 psi. Re-squeeze if necessary.

6. Circulate clean, POOH standing back tubing string and L/D BHA.

7. Trip in hole open ended tubing to 4650'.

8. N/D BOP's, N/U and test tree. Swab fluid down to 1500'.

9. R/U Halliburton wireline and test wireline lubricator. Run TMDL pulsed neutron log from 4715'- 4600' to determine residual gas saturations through productive interval.

10. GIH with 2-1/8" Deep Star thru tubing perforating gun, 6 shots/ft, Tri-Phase phasing. Perforate 4684'- 4690' DIL. Swab well in if necessary.

    Note: Perforations could change depending on results of cased hole neutron log.

11. Unload and test well as needed. Obtain gas sample.

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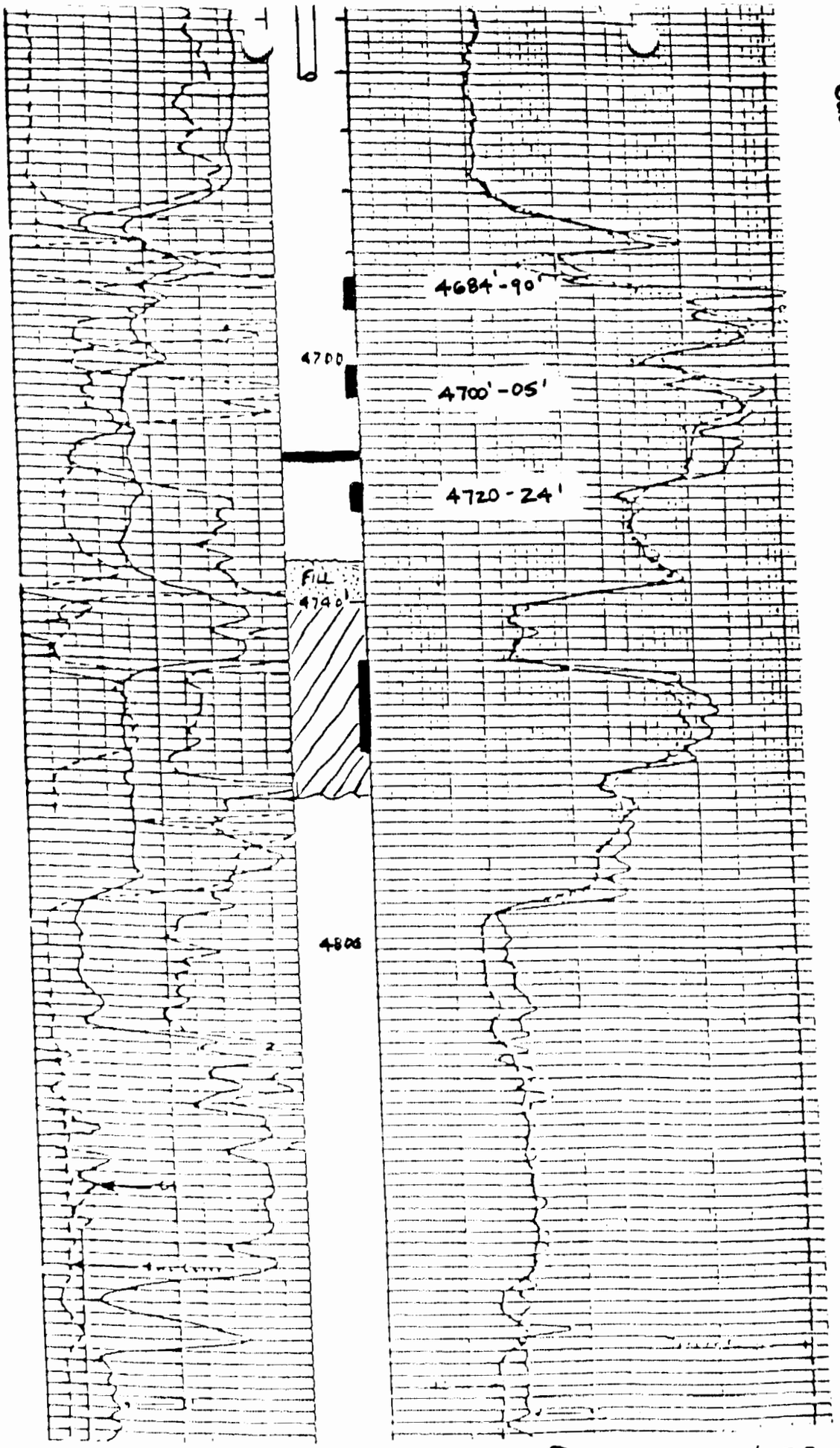

PIACENTINE 1-27 WELL
SIERRA RESOURCES, INC.

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	11/2/98
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	____	Water Disposal	____
Idle - Oil	____	Waterflood	____
Abandoned - Oil	____	Steamflood	____
Drilling - Idle	____	Fire Flood	____
Abandoned - Dry Hole	____	Air Injection	____
Producing - Gas	X	Gas Injection	____
Idle - Gas	____	CO_2 Injection	____
Abandoned - Gas	____	LPG Injection	____
Gas-Open to Oil Zone	____	Observation	____
Gas Storage	____	Waterflood Source	____

DATE 5/18/98 "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 ✓ gv
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

WORK PERFORMED

Drill _____ Redrill _____ Deepen _____

Plug _____ Alter Casing _____

Waterflood _____ Water Disposal _____

Abandon _____

Other _____

STATUS **DATE**

Producing _____ "E" well Yes ☐ No ☐

Recompleted Producing _____

Waterflood _____

Water Disposal _____

Abandoned _____

Other _____

MAP AND BOOK _____ Engineer _____

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

_____

_____

_____

Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____

(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____

and

File cleared _____ OGD121 _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

450 Fairway Drive #705
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 6/26/98

RECOMPLETION HISTORY

DATE	REMARKS
5/18/98	R/U Halliburton wireline and test wireline lubricator. GIH with 1-11/16" Deep Star thru tubing perforating gun, 4 shots/ft, 90 degree phasing. Perforate 4684'- 4690' DIL. **Unload and test well @ ± 500 mcf/day with 1120 psi FTP and 1190 psi SITP.** Obtain gas sample. Rig down and release Halliburton wireline unit.

Div. of Oil & Gas - Dist. 6
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NOV 02 1998
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

PERMIT TO CONDUCT WELL OPERATIONS

No. P 697-333
351 (field code)
00 (area code)
10 (new pool code)
10 (old pool Code)

Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
Truxtun Avenue, Suite 250
Bakersfield, CA 93309

Sacramento, California
August 26, 1997

Your proposal to rework well "Placentine" 1-27, A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D.B.& M., King Island Gas field, Any area, Mokelumne River pool, San Joaquin County, dated 8/18/97, received 8/21/97 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 2M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 2 M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To inspect the installed blowout prevention equipment prior to commencing operations.

Engineer Robert S. Habel

Phone (916) 322-1110

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

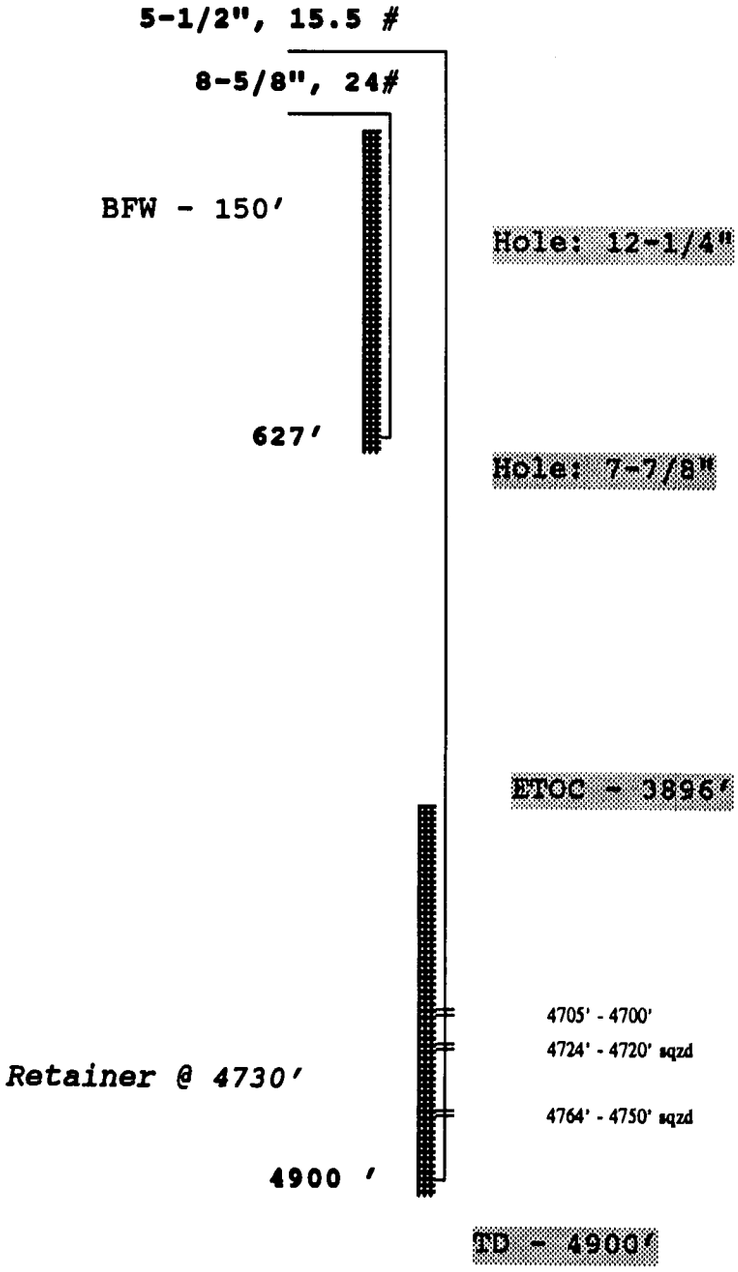
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (2/95/GSR1/5M)

"Piacentine" 1-27
077-20484

Spud Date:7/4/86
RSH - August 26, 1997
Well Class - Development



KEY

|	Casing	▓	Cement
┼	WSO Hole	⊕	Fish
╪	Perf.	■	Bridge plug/Retainer

Div. of Oil & Gas - Dist. 6
RECEIVED
AUG 2 1 1997
Sacramento, California

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD114	OGD121
BB	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE # 1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., RIO BLANCO Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD = 4715' (Bridge Plug)

2. Complete casing record, including plugs and perforations (present hole)
   8-5/8" 24# K-55 ST&C 8RD casing set at 627'.
   5-1/2" 15.5# K-55 LT&C 8RD casing set at 4900'.

   Perforations: 4750'- 4764' - squeezed 5/9/91.
   4720'- 4724' - squeezed 3/5/97.

   4700'- 4705' open & producing.

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted same

4. Present zone pressure ± 1100 psi ; New zone pressure ± 1200 psi

5. Last produced currently on production (Date) | -0- (Oil, B/D) | 5 BWPD (Water, B/D) | 300 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) | (Water, B/D) | (Gas, Mcf/D) | (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:

1) R/U Electric wireline and add additional perforations as follows:
   4684' - 4690' DIL.

2) R/D wireline and return well to production.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 5601 Truxtun Ave. Ste. 250 (Street)
Bakersfield, CA 93309 (City) (State) (Zip)
Telephone Number (805) 631-8378
FAX (805) 631-9761

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name - Printed)
Robert D Eberts (Name - Signature) 8/18/97 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. [illegible] Sec. _____, T. _____, R. _____, _____ B. & M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	REWORK 5/5
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil		Water Disposal	
Idle - Oil		Waterflood	
Abandoned - Oil		Steamflood	
Drilling - Idle		Fire Flood	
Abandoned - Dry Hole		Air Injection	
Producing - Gas	X	Gas Injection	
Idle - Gas		CO_2 Injection	
Abandoned - Gas		LPG Injection	
Gas-Open to Oil Zone		Observation	
Gas Storage		Waterflood Source	

DATE 3/3/97 "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core Record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change _____ (F-OGD165) _____
2. Elevation change _____ (F-OGD165) _____
3. Form OGD121 ✓
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records Due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED

Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (1/96/GSR1/1M)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B. & M.

WORK PERFORMED

Drill _____ Redrill _____ Deepen _____

Plug _____ Alter Casing _____

Waterflood _____ Water Disposal _____

Abandon _____

Other _____

STATUS **DATE**

Producing _____ "E" well Yes ☐ No ☐

Recompleted Producing _____

Waterflood _____

Water Disposal _____

Abandoned _____

Other _____

MAP AND BOOK _____ Engineer _____

RECORDS FILED AND DATE Clerk _____

Summary _____

Log and Core _____

History _____

E-log _____

_____

Directional Survey _____

Other _____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location _____ Notice states _____

_____

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Elevation _____ Notice states _____

_____

_____

_____

Production Reports _____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer ____

_____

_____

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_____

_____

_____

Surface Inspection _____

Data Needed _____

Request Records _____ OGD170 _____

Correct Records _____ OGD165 _____

(Specify)

EDP _____ (OGD42A-1, 2) _____

CARDS _____

BOND _____

Hold _____ Reason _____

Release _____ Date Eligible _____ OGD150 _____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection _____ Engineer _____

FINAL LETTER _____ OG159 _____

and

File cleared _____ OGD121 _____

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.
2 Hidden Lake Circle
P.O. Box 2788
Mammoth Lakes, CA 93546-2788
(760) 934-3356
FAX (760) 934-5637
e-mail: sri@qnet.com

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 2/28/01

RECOMPLETION HISTORY

DATE	REMARKS
8/9/97	MIRU rig. R/U on tree. Mix HEC pill and load well with lease water to kill same. Lubricated HEC pill to perforations to minimize fluid loss to producing zone. Filled tubing annulus as required and bled off gas. Secured well for night.
8/10/97	Opened well - dead. N/D tree, N/U and test BOP's. Released packer and filled hole as required. RIH to 4736' (tag depth). POOH slowly, keeping hole full and layed down 2-7/8" tubing and packer. R/U Halliburton wireline. Made gauge ring run to 4718', ran and set bridge plug @ 4715'. R/D Halliburton wireline. RIH and landed 2-3/8" production tubing with muleshoe tail @ 4650'. N/D BOP's, N/U and test tree. Note: Installed soap pump on 5-1/2" casing. Secured well for night.
8/11/97	Opened well - dead. Rigged up swab line, swabbed well in and returned well to production in current perforations (4700 - 4705' DIL).

Received Late

Div. of Oil & Gas - Dist. 6
RECEIVED
FEB 2 ? 2001
Sacramento, California

Well: Piacentine #1-27
API#: 04-077-20484
Field: King Island
S/T/R: S27-T3N/R5E, MDB&M
County: San Joaquin
State: California

Operator: SIERRA RESOURCES, INC.

5601 Truxtun Avenue
Suite 250
Bakersfield, CA 93309
(805) 631-8378
FAX (805) 631-9761

Signed: Robert D Eberts
Robert D. Eberts, President

Date: 4/30/97

Div. of Oil & Gas - Dist. 6
RECEIVED

MAY 0 5 1997

Sacramento, California

RECOMPLETION HISTORY

DATE	REMARKS
2/26/97	MIRU Oil Well Service rig. R/U on tree. Pump in well with lease water and attempt to kill same. Pressured up to 2000 psi with 30 barrels down tubing. Flowed back 25 barrels and shut in well with 640 psi SITP. Mix 72 lb/bbl salt water and kill well with same. N/D Tree and N/U BOP's with 2-7/8" rams and test same. Released packer and circulate well. POOH, laid down packer and stood back tubing. RIH with open ended tubing to 4727' and secured well for night.
2/27/97	Opened well - no pressure. Pumped 40 bbls lease water with no returns. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement plug and equalize plug with lease water - CIP @ 10:50 am. POOH ten stands and reverse circulate clean. Braden head squeeze to 2000 psi, shut in well under pressure and secured well for night.
2/28/97	Opened well - 650 psi SITP. Bled off same and RIH with tubing, tagging cement @ 4573'. POOH and made up drilling BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4573'. R/U power swivel and drill out soft cement from 4573' to 4675'. Circulate clean and secured well for night to wait on cement.
3/03/97	Resumed drilling on firm cement from 4675' to 4730'. Pressure up to 700 psi - broke down taking 2-1/2 bbls/minute @ 500 psi. POOH and stand back BHA. RIH with open ended tubing to 4730'. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement w/ 2.5% CaCl and equalize plug with lease water - CIP @ 1:30 pm. POOH ten stands and reverse circulate clean. Braden head squeeze to 2500 psi, shut in well under pressure and secured well for night to allow cement to harden.

Div. of Oil & Gas - Dist. 6
RECEIVED
MAY 0 5 1997
Sacramento, California

RECOMPLETION HISTORY
PAGE 2

3/04/97 Opened well - 1500 psi SITP. Bled off same and RIH with tubing, tagging cement @ 4556'. POOH and made up drilling BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4556'. R/U power swivel and drill out firm cement from 4556' to EZSV retainer @ 4730'. Continue drilling out retainer , cement and junk to 4758', began torquing up badly. POOH and inspect bit. RIH with same and resumed drilling, changing weight and RPM - unable to make progress. Pressure up to 900 psi - well taking fluid @ 2 bbls/minute. Secured well for night.

3/05/97 POOH and stand back BHA. RIH with open ended tubing to 4754'. R/U cementers and test lines and manifold. Mix and pump 30 sx neat "G" cement w/ 2.5% CaCl and equalize plug with lease water - CIP @ 11:30 am. POOH ten stands and reverse circulate clean. Braden head squeeze to 2000 psi, shut in well under pressure and secured well for night to allow cement to harden.

3/06/97 Opened well - 50 psi SITP. Bled off same and RIH with tubing, tagging cement @ 4551'. POOH and made up drilling BHA. Trip in hole with bit and BHA on tubing string. Tag cement @ 4551'. R/U power swivel and drill out firm cement from 4551' to 4740'. Circulate clean and pressure test squeeze to 1100 psi, test held. Made up casing scraper and round trip to 4740'. Made up 5-1/2" x 2-7/8" "Big Bore" R-3 packer and TIH with production setting as before. Secured well for night.

3/07/97 Continue TIH with 5-1/2" x 2-7/8" "Big Bore" R-3 packer and production setting. Set production packer @ 4585' w/ 12,000# in compression. Test packer to 1000 psi on casing and land tubing. N/D BOP's, N/U and test tree. Swab fluid down to 1500'. Secured well for night.

3/08/97 R/U Halliburton wireline and test wireline lubricator. Attempt to Run TMDL log - hit obstruction @ 4733'. Unable to clear - forced to trip and reset production setting to clear obstruction. R/U Halliburton wireline and test wireline lubricator. Ran TMDL pulsed neutron log from 4723'- 4490' to determine residual gas saturations. GIH with 2-1/8" Deep Star thru tubing perforating gun, 6 shots/ft, Tri-Phase phasing. Perforate 4700'- 4705' DIL. **Unload and test well @ ± 600 mcf/day with 1120 psi FTP and 1180 psi SITP.** Obtain gas sample. Rig down and release rig.

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

PERMIT TO CONDUCT WELL OPERATIONS

No. P 696-354
351 (field code)
00 (area code)
10 (new pool code)
10 (old pool Code)

Robert D. Eberts, Agent
SIERRA RESOURCES, INC.
5601 Truxtun Ave., Suite 250
Bakersfield, CA 93309

Sacramento, California
November 20, 1996

Your proposal to rework well "Piacentine" 1-27, A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D.B.& M., King Island Gas field, Any area, Mokelumne pool, San Joaquin County, dated 11/12/96, received 11/18/96 has examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "II" B 2M requirements is installed on the 5-1/2" casing and maintained in operating condition at all times. See Manual M07.

2. Wire line operations are conducted through at least a 2 M lubricator.

3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.

4. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing programs and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.

Blanket Bond
RSH:sr

Engineer Robert S. Habel

Phone (916) 322-1110

WILLIAM F. GUERARD, JR., State Oil and Gas Supervisor

By Robert A. Reid

Robert A. Reid, *Deputy Supervisor*

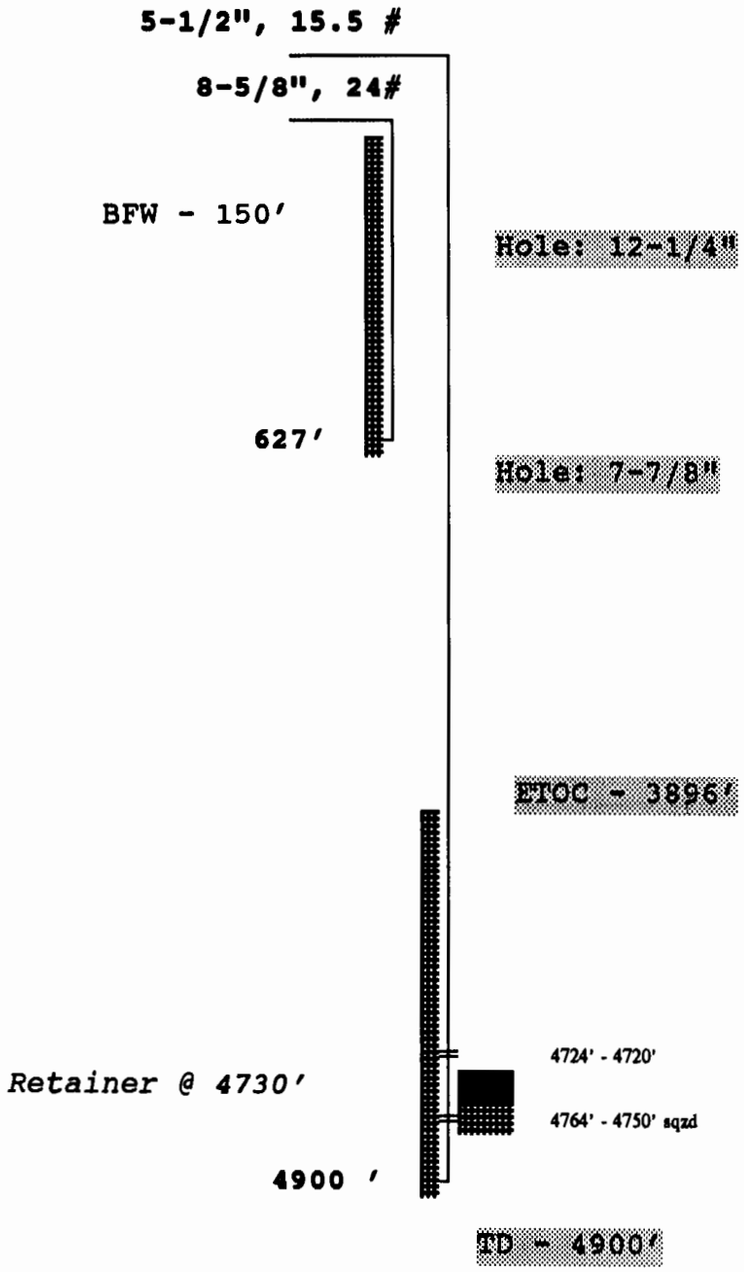
A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (2/95/GSR1/5M)

"Piacentine" 1-27
077-20484

Spud Date:7/4/86
RSH - November 20, 1996
Well Class - Development



KEY

|	Casing		Cement
┼	WSO Hole	⊕	Fish
╪	Perf.		Bridge plug/Retainer

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 18 1996
Sacramento, California

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
BB	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE #1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., RIO BLANCO Field, SAN JOAQUIN County.

The present condition of the well is as follows:

1. Total depth 4900'
   PBTD 4730'

2. Complete casing record, including plugs and perforations (present hole)

   8 5/8" 24# K-55 ST&C 8Rd. casing set at 627'.
   5 1/2" 15.5 # K-55 LT&C 8Rd casing set at 4900'.

   Perforations: 4750'-4764' - squeezed 5/9/91.
   4720'-4724' - open

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure ± 1500psi (est) ; New zone pressure + 2000 psi (est)

5. Last produced currently on production (Date) | -0- (Oil, B/D) | 50 BWPD (Water, B/D) | 300 MCFD (Gas, Mcf/D)

   (or)

   Last injected N/A (Date) | (Water, B/D) | (Gas, Mcf/D) | (Surface pressure, psig)

6. Is this a critical well according to the definition on the reverse side of this form? ☐ (Yes) ☒ (No)

The proposed work is as follows:
Recomplete to shallower zone within Mokelumne Sand. Present interval depleting.
See detailed workover procedure attached.

Note: If well is to be redrilled, show proposed new bottom-hole coordinates and true vertical depth.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 5601 Truxtun Ave. Ste 250 (Street)
Bakersfield CA 93309 (City) (State) (Zip)
Telephone Number (805) 631-8378
FAX (805) 631-9761

Sierra Resources, Inc. (Name of Operator)
By Robert D. Eberts (Name - Printed)
Robert D. Eberts (Name - Signature) 11/12/96 (Date)
Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

OG107 (11/88/DWRR/5M)

Div. of Oil & Gas - Dist. 6
RECEIVED
NOV 18 1996
Sacramento, California

PIACENTINE #1-27 WELL
WORKOVER PROGRAM
NOVEMBER 12, 1996

WELL INFORMATION

API No: 04-077-20484 FIELD: King Island

ELEVATION: All measurements from KB (13' above GL)
(KB-THF = 11.5')

TD: 4900' PBTD: 4730'

CASING INFO: 8-5/8" 24# J-55 csg. from surface to 627'

5-1/2" 15.50#, K-55 LT&C csg. from surface to 4900' cemented with 150 sx (TOC @ 4175')

EXISTING PERFORATIONS: 4720'- 4724' (open)
4750'- 4764' (squeezed)

BOTTOM HOLE PRESSURE DATA: ± 1500 psi (current zone)
± 2000 psi (new zone)

PROPOSED PERFORATIONS: 4700'- 4710' EL (4701'- 4711' DN)

PRODUCING FORMATION: Mokelumne (current & proposed perfs)

WORKOVER PROGNOSIS

1. MIRU rig. R/U on tree. Pump in well with lease water and kill same. Fill tubing annulus as required. N/D tree and N/U BOP's.

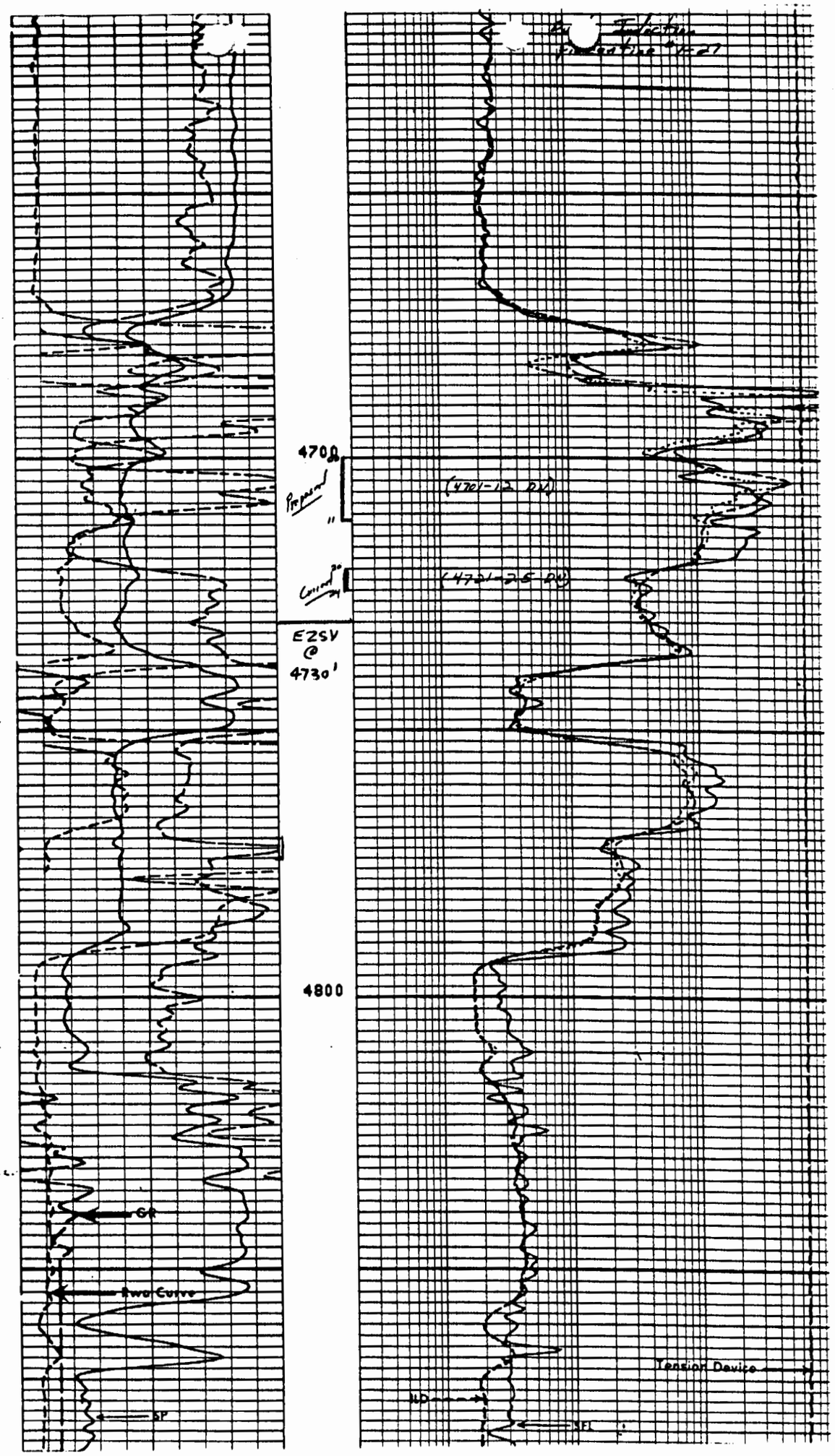
2. Release packer and circulate out. POOH slowly, keeping hole full.

3. R/U wireline. Make gauge ring/junk basket run to 4720'. Set wireline CIBP @ 4715'. POOH with wireline and test casing to 1000 psi.

4. Trip in hole with redressed packer and production setting as before. Set production packer @ ± 4600'. Test packer to 1000 psi on casing.

5. N/D BOP's, N/U and test tree. Swab fluid down to 2000'. R/U and test wireline lubricator. GIH with 1-11/16" thru tubing perforating gun. Perforate 4700'-10' EL (4701'-4711' DN) w/ 4-SPF.

6. Unload and test well as needed. Obtain gas sample. R/D and release rig.



4700
Proposed
(4701-12 DN)
Cursed
(4721-25 DN)
E2SV
@
4730'
4800
GR
Rwa Curve
SP
Tension Device
ILD
SFL

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF PROPERTY AND WELL TRANSFER

Field or county	District
SAN JOAQUIN COUNTY	6
Former owner	**Date**
QUINTANA PETROLEUM CORPORATION	12/27/94

Name and location of well(s)

"MORESCO ET AL UNIT A" #1	28/3N/5E	007-20469
"PIACENTINE" 1-27	27/3N/5E	077-20484

Description of the land upon which the well(s) is (are) located

Date of transfer, sale, assignment, conveyance, or exchange	New owner	Type of organization
12/1/94	SIERRA RESOURCES, INC.	CORP.
	Address 5601 Truxtun Ave. Suite 250 Bakersfield, CA 93309	Telephone No. (805) 631-8378

Reported by: K. Briggs - QUINTANA

Confirmed by: R. Eberts - SIERRA

New operator new status (status abbreviation)	Request designation of agent
PA	
Old operator new status (status abbreviation)	**Remarks**
PA	

Deputy Supervisor: ROBERT A. REID

Signature: Robert A. Reid 12/28/94

OPERATOR STATUS ABBREVIATIONS

PA – Producing Active
NPA – No Potential, Active
PI – Potential Inactive
NPI – No Potential, Inactive
Ab – Abandoned or No More Wells

FORM AND RECORD CHECK LIST

Form or record	Initials	Date	Form or record	Initials	Date
Form OGD121			Map and book		
Form ODG148			Notice to be cancelled		
New well cards			Bond status		
Well records			EDP files		
Electric logs					
Production reports					

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF CORRECTION OR CANCELLATION

Sacramento, California

January 27, 1994

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Dr., Suite 133
Bakersfield, CA 93309

In accordance with your request

the following change pertaining to your well "Piacentine" 1-27 (Well designation),
King Island Gas field, San Joaquin County,
Sec. 27, T. 3N, R. 5E, M.D. B. & M., is being made in our records:

☐ The corrected location is

☐ The corrected elevation is

☐ Report No. , dated , has been corrected as follows:

☒ Your notice to rework (Drill, abandon, etc.) dated 8/13/92, and our report No. P 692-295, issued in answer thereto, are hereby cancelled inasmuch as the work will not be done. If you have an individual bond on file covering this notice, it will be returned. No request for such return is necessary.

☐ Other:

William F. Guerard, Jr.
State Oil and Gas Supervisor

By Robert A. Reid
Deputy Supervisor

ROBERT A. REID

OG165 (2/88/DWRR/3M)

RESOURCE AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
District 6, (916) 322-1110

No. P 692-295

351 (field code)

00 (area code)

10 (new pool code)

10 (old pool code)

PERMIT TO CONDUCT WELL OPERATIONS

James R. Weddle, Agent
QUINTANA PETROLEUM CORPORATION
1400 Easton Dr., Suite 411
Bakersfield, CA 93309

Sacramento, California
August 25, 1992

Your proposal to rework well "Piacentine" 1-27
API No. 077-20484 Section 27, T. 3N, R. 5E, M.D. B. & M.,
King Island Gas field, any area, Mokelumne pool,
San Joaquin County, dated 8-13-92, received 8-25-92 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Blowout prevention equipment conforming to Class "III" 3M requirements is installed on the 5 1/2" casing and maitained in operating condition at all times. See Manual M07 and attached sheet.
2. Wire line operations are conducted through at least a 3M lubricator.
3. The Division is furnished copies of any draw down or back pressure tests performed. In addition, the Division will monitor the production for a period of six months and if anomalous water is indicated, remedial action will be ordered.

THIS DIVISION IS NOTIFIED:

a. Before deviating from the proposed program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.

Blanket Bond
RSH:jhs

Rec'd/Co Rep. 11/6/92
Work has not been done as yet because the presently open interval increased to about ± 300 Mcf/d. When this interval becomes non-commercial, the interval covered by this notice will be perforated.

K.P. Henderson, Acting Chief

By Robert A. Reid
Deputy Supervisor
Robert A. Reid

A copy of this report and the proposal must be posted at the well site prior to commencing operations. Records for work done under this permit are due within 60 days after completion, suspension, or abandonment.

OG 107 (8/79)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

Div. of Oil & Gas - Dist.
RECEIVED

DIVISION OF OIL AND GAS

AUG 25 1992

Sacramento, California

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
Bb	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE #1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., Rio Blanco Field, San Joaquin County.

The present condition of the well is as follows:

1. Total depth 4900'

2. Complete casing record, including plugs and perforations

   8 5/8" 24# K-55 ST&C 8Rd casing set at 627'.
   5 1/2" 1.55# K-55 LT&C 8Rd casing set at 4900'.

   Perforations: 4750'-4764' - squeezed 5/9/91.
   4720'-4730' - open

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure unknown (depleting) ; New zone pressure ±2000 psi (est)

5. Last produced currently on production (Date) | -0- (Oil, B/D) | -0- (Water, B/D) | 266 mcfd (Gas, Mcf/D)

   (or)

   Last injected _____ (Date) | _____ (Water, B/D) | _____ (Gas, Mcf/D) | _____ (Surface pressure, psig)

The proposed work is as follows:

Recomplete to shallower zone within Mokelumne Sand. Present interval depleting. See detailed workover procedure attached.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 1325 So. Colorado Blvd., Ste. 411 (Street)
Denver (City) Colorado (State) 80222 (Zip)

Telephone Number (303)692-9559

QUINTANA PETROLEUM CORPORATION (Name of Operator)

By J. M. Snider (Print Name)

J. M. Snider (Signature) 8/13/92 (Date)

WORKOVER RECOMMENDATION

WELL NAME: PIACENTINE NO. 1-27 AFE NO: 52008

DATE: August 11, 1992 PRIORITY: _____

DISTRICT: Western FIELD: King Island

ELEVATION: 11.5' KB-THF TD: 4900' PBTD: 4730'

CASING SIZE & SETTING DEPTH: 5-1/2" 15.50#, K-55, LT&C cemented with 150 sx TOC @ 4175'

PROPOSED PERFS: 4701'-12' DN 4-SPF

PRODUCING FORMATION: Mokelumne (Perfs 4720'-24')

BOTTOM HOLE PRESSURE DATA: ± 2050 psi (estimated)

PACKER/ANCHOR: Baker "R-3" packer @ 4611'

TUBING SIZE & DEPTH: 2-7/8", 6.5#, J-55, EUE, 8rd at 4611'

PUMP: N/A

RODS: N/A

WELL HEAD: 11" 3M X 7-1/16" 3M

LAST PRODUCTION TEST: _____ BOPD _____ MCFPD _____" CHOKE

REASON FOR WORKOVER: Recomplete to shallower zone within the Mokelumne Sand. Present interval depleting.

PREPARED BY: T.M. Stone RESERVOIR DEPT.: _____

PRODUCTION DEPT.: _____ APPROVED BY: _____

WORKOVER PROCEDURE

1. MIRU rig. R/U on tree. PI well with 9.4 ppg brine water and kill well. Fill tubing annulus as required. N/D tree, N/U BOP's.

2. Release packer. Circulate out. POOH slow – keep hole full.

3. R/U wireline. Make gauge ring-junk basket run to ± 4720'. Set wireline CIBP at 4715'. POOH with wireline. Test casing to 1000 psi.

4. GIH with production setting as before. Set production packer at ± 4600'. Test packer to 1000 psi on casing.

5. N/D BOP's. N/U and test tree. Swab fluid down to 2000'. R/U and test lubricator. GIH with 1-11/16" thru tubing perforating gun. Perforate 4701'-12' DN 4-SPF.

6. Unload and test well as needed. Obtain gas sample. Release rig.

DIVISION OF OIL AND GAS
CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company _____ Well No. _____

API No. 077-20484 Sec. _____, T. _____, R. _____, _____ B.&M.

County _____ Field _____

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	RENORK 8/28/91
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs:	

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Waterflood	___
Abandoned - Oil	___	Steamflood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	X	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Gas Storage	___	Waterflood Source	___

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change ____ (F-OGD165) _____
2. Elevation change ____ (F-OGD165) _____
3. Form OGD121 _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

RECORDS NOT APPROVED
Reason: _____

RECORDS APPROVED MFC

RELEASE BOND _____
Date Eligible _____
(Use date last needed records were received.)

MAP AND MAP BOOK N/C

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (5/89/GSR1/5M)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No._____

API No._____ Sec._____, T._____, R._____, _____B.&M.

WORK PERFORMED

Drill_____ Redrill_____ Deepen_____

Plug_____ Alter Casing_____

Waterflood _____ Water Disposal_____

Abandon_____

Other_____

STATUS **DATE**

Producing_____"E" well Yes☐ No☐

Recompleted Producing_____

Waterflood _____

Water Disposal_____

Abandoned_____

Other_____

MAP AND BOOK_____ Engineer_____

RECORDS FILED AND DATE Clerk_____

Summary_____

Log and Core_____

History_____

E-log_____

_____

Directional Survey_____

Other_____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location_____ Notice states_____

_____

_____

_____

_____

Elevation_____ Notice states_____

_____

_____

_____

Production Reports_____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection_____

Data Needed_____

Request Records_____ OGD170____

Correct records_____ OGD165____
(Specify)

EDP_____(OGD42A-1, 2) ___

CARDS_____

BOND_____

Hold_____ Reason_____

Release____ Date Eligible_____ OGD150____

End premium year _____

Release requested _____

Bond superseded _____ (Check One)

Well abandoned _____

Environmental Inspection_____ Engineer____

FINAL LETTER_____ OG159____
and
File cleared _____ OGD121____

OGD2 (LONG BEACH)

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

DIVISION OF OIL AND GAS
RECEIVED
MAY 2 8 1991
WOODLAND, CALIFORNIA

Operator Quintana Petroleum Corporation Field ..... County San Joaquin
Well PIACENTINE #1-27, Sec. 27, T 3N, R 5E, MD B. & M.
A.P.I. No. 04-077-20484 Name J. M. Snider (Person submitting report) Title Production Tech. (President, Secretary or Agent)
Date May 21, 19 91

Signature J M Snider

1325 So. Colorado Blvd., Suite 411, Denver, CO 80222 (Address) (303)692-9559 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date		
		Workover - AFE #51006 Purpose: Recomplete to shallower zone within Mokelumne Sand.
5/7/91	4856'	Day 1. RD flowline and equipment. Prep to MI WO rig. DC $1179 CTD $1179
5/8/91	4856'	Day 2. MW 9.4 MI RU Snow Oilfield Service Rig #8. RU lines. PI and killed well w/40 bbls 9.4 ppg brine water. Well on vacuum. ND tree. NU BOP's. Tested BOP's. Release packer and POOH. RU wireline. Ran gauge ring and junk basket to 4740'. WIH w/EZSV and set at 4730'. Closed BR and tested casing and retainer to 1000 psi. SWIFN. DC $6523 CTD $7702
5/9/91	4730'	Day 3. MW 8.8 TIH w/stinger. Test retainer on casing to 1000 psi. Mixed 50 sxs Class "G" cement at 15.8 ppg. Squeezed perforations 4750'-4764' at final rate of 1/2 bpm 2600 psi, 1500 psi static. Reversed out 5 sxs cement. POOH. GIH w/production tubing. Set packer at 4611'. Tested pkr to 1000 psi. ND BOP's. NU tree. SWIFN. DC $7906 CTD $15,608
5/10/91	4730'	Swbd well to 1200'. Perforated 4720'-4724' with 4 jspf. RU swab. Tagged FL at 1200'. Swbd to 2500', well started unloading. Cleaned up well. Final flow on 12/64" ck 800 MCFD, FTP 1050 psi. No water. SI well. 30 min SIP 1100 psi. RD and release rig. DC $6785 CTD $22,393 FINAL REPORT
5/14/91		Well returned to production 9:00 a.m.

Piacentine #1-27
2 7/8" Tubing Detail
May 8, 1991

1	2 7/8" MULESHOE	.88
1	5 1/2" BAKER MODEL R DOUBLE GRIP PKR	7.18
1 JT	2 7/8" 6.5# J-55 EUE TUBING	31.14
1	2 7/8" F NIPPLE (I.D. 2.31")	.97
149 JTS	2 7/8" 6.5# J-55 EUE TUBING	4,557.42
1	2 7/8" TUBING HANGER	.80
	TOTAL TUBING AND EQUIPMENT	4,598.39
	DISTANCE RKB TO HANGER	+13.00
	EFFECTIVE TUBING SETTING	4,611.39

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 691-121

PERMIT TO CONDUCT WELL OPERATIONS

351 (field code)
00 (area code)
10 (new pool code)
10 (old pool code)

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Woodland, California
April 1, 1991

Your _____ proposal to rework well "Piacentine" 1-27,
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B. & M.,
King Island Gas field, Any area, Mokelumne River pool,
San Joaquin County, dated 3/25/91, received 3/29/91 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. Wire line operations are conducted through at least a 3M lubricator.

Blanket Bond
LFC/km
cc: Co. Prudential Plaza

Engineer _____

Phone _____

M. G. MEFFERD, State Oil and Gas Supervisor
By Robert A. Reid
Acting Deputy Supervisor
ROBERT A. REID

A copy of this permit and the proposal must be posted at the well site prior to commencing operations.

Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (3/90/GSR1/5M)

OG107 (8/79)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
MAR 2 9 1991
WOODLAND, CALIFORNIA

Notice of Intention to Rework Well

This notice and indemnity or cash bond shall be filed, and approval given, before rework begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

FOR DIVISION USE ONLY		
BOND	FORMS	
	OGD 114	OGD 121
bb	✓	✓

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to rework well PIACENTINE #1-27 (Well designation), API No. 04-077-20484

Sec. 27, T. 3N, R. 5E, MD B. & M., Rio Blanco Field, San Joaquin County.

The present condition of the well is as follows:

1. Total depth 4900'

2. Complete casing record, including plugs and perforations
   8 5/8" 24# K-55 STUC 8Rd casing set at 627'.
   5 1/2" 15.5# K-55 LT&C 8Rd casing set at 4900'.
   Perforations: 4750'-4764'

3. Present producing zone name Mokelumne ; Zone in which well is to be recompleted Mokelumne

4. Present zone pressure unknown (depleting) ; New zone pressure ±2060 psi (est)

5. Last produced 3/23/91 (Date) | -0- (Oil, B/D) | 7.5 (Water, B/D) | 178 (Gas, Mcf/D)

   (or)

   Last injected _____ (Date) | _____ (Water, B/D) | _____ (Gas, Mcf/D) | _____ (Surface pressure, psig)

The proposed work is as follows:

Recomplete to shallower zone within Mokelumne Sand. Present interval depleting. See detailed workover procedure attached.

It is understood that if changes in this plan become necessary, we are to notify you immediately.

Address 1362 So. Colorado Blvd., Suite 411 (Street)
Denver (City) Colorado (State) 80222 (Zip)
Telephone Number (303)692-9559

QUINTANA PETROLEUM CORPORATION (Name of Operator)
By J. M. Snider (Print Name)
J M Snider (Signature) 3/25/91 (Date)

WORKOVER RECOMMENDATION

WELL NAME: Piacentine #1-27 AFE NO: 51006

DATE: 3/19/91 PRIORITY:

DISTRICT: Western FIELD: King Island

ELEVATION: 11.5' KB-THF TD: 4900' PBTD: 4856'

CASING SIZE & SETTING DEPTH: 5 1/2" 15.5#, K-55 LT&C Cemented with 150 sx - TOC @ 4175'

PROPOSED PERFS: 4720'-24' CET, 4721'-25' DN 4SPF

PRODUCING FORMATION: Mokelumne (Perfs 4750'-64')

BOTTOM HOLE PRESSURE DATA: ±2060 PSI (Estimated)

PACKER/ANCHOR: Baker "R-3" Packer @ 4702'

TUBING SIZE & DEPTH: 2 7/8", 6.5# J-55, EUE 8RD @ 4702.14'

PUMP: N/A

RODS: N/A

WELL HEAD: 11" 3M X 7 1/16" 3M

LAST PRODUCTION TEST: 0 BOPD 190 MCFPD " CHOKE

REASON FOR WORKOVER: Recomplete to shallower zone w/in Mokelumne Sand. Present interval depleting.

PREPARED BY: Thomas M. Stone TMS RESERVOIR DEPT.:

PRODUCTION DEPT.: APPROVED BY:

WORKOVER PROCEDURE

1. MIRU rig. R/U on tree. PI well w/ 9.4 PPG brine water and kill well. Fill tubing annulus as required. N/D tree. N/U bop's.

2. Release packer. Circ out. POOH slow keeping hole full.

3. R/U wireline. Make gauge ring and junk basket run to ±4750'. Set wireline EZSV @ 4730'. GIH w/ stinger. Test retainer on casing to 1000 psi. Squeeze cement perforations 4750'-64' using 50 sx cement. POOH.

4. GIH w/ production setting as before. Set production packer @ ±4600'. Test packer to 1000 PSI on casing.

5. N/D bop's. N/U and test tree. Swab fluid down to 1200'. R/U and test lubricator. GIH w/ 1 11/16" thru tubing perf gun. Perforate. 4720'-24' CET 4 SPF.

6. Unload and test well as needed. Obtain gas sample. Release rig.

DIVISION OF OIL AND GAS

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Company Pantana Petr. Corp Well No. "Placentia" 1-27

API No. 077-20484 Sec. 27, T. 3N, R. 5E, MD B.&M.

County San Joaquin Co. Field

RECORDS RECEIVED	DATE
Well Summary (Form OG100)	
History (Form OG103)	
Core Record (Form OG101)	
Directional Survey	
Sidewall Samples	
Other	
Date final records received	
Electric logs: Velan 5" ✓	
Dir Analysis Log 5" ✓	
Cyberlook 5" ✓	
CBL 5" ✓ Dis/Sus	
Comp Comp Log 5" ✓	
TDT 5" ✓	
Mud 2" ✓	

STATUS		STATUS	
Producing - Oil	___	Water Disposal	___
Idle - Oil	___	Waterflood	___
Abandoned - Oil	___	Steamflood	___
Drilling - Idle	___	Fire Flood	___
Abandoned - Dry Hole	___	Air Injection	___
Producing - Gas	___	Gas Injection	___
Idle - Gas	___	CO_2 Injection	___
Abandoned - Gas	___	LPG Injection	___
Gas-Open to Oil Zone	___	Observation	___
Gas Storage	___	Waterflood Source	___

DATE _____ "E" well Yes ☐ No ☐

RECOMPLETED _____

REMARKS _____

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) _____
2. Electric Log _____
3. Operator's Name _____
4. Signature _____
5. Well Designation _____
6. Location _____
7. Elevation _____
8. Notices _____
9. "T" Reports _____
10. Casing Record _____
11. Plugs _____
12. Surface Inspection _____
13. Production _____
14. E Well on Prod., enter EDP _____
15. Directional Survey _____

CLERICAL CHECK LIST

1. Location change ____ (F-OGD165) _____
2. Elevation change ____ (F-OGD165) _____
3. Form OGD121 ✓ _____
4. Form OG159 (Final Letter) _____
5. Form OGD150b (Release of Bond) _____
6. Duplicate logs to archives _____
7. Notice of Records due (F-OGD170) _____
8. EDP (F-OGD42A-1, 2) _____

077 20484

RECORDS NOT APPROVED RT 7/3/86

Reason: Need:

- (2) Well summaries
- (2) Well histories
- (2) DIL 2"
- (2) Sonic 2"
- Cut inspection prod.

RECORDS APPROVED _____

RELEASE BOND _____

Date Eligible _____

(Use date last needed records were received.)

MAP AND MAP BOOK _____

LONG BEACH OFFICE - USE REVERSE SIDE

OGD2 (7/85/DWRR/SM)

CHECK LIST - RECORDS RECEIVED AND WELL STATUS

Well No. _____

API No. _____ Sec. _____, T. _____, R. _____, _____ B.&M.

WORK PERFORMED	STATUS	DATE
Drill_____ Redrill_____ Deepen_____	Producing_____ "E" well Yes☐ No☐	
Plug_____ Alter Casing_____	Recompleted Producing_____	
Waterflood _____ Water Disposal_____	Waterflood _____	
Abandon_____	Water Disposal_____	
Other_____	Abandoned_____	
	Other_____	
	MAP AND BOOK_____ Engineer_____	

RECORDS FILED AND DATE Clerk_____

Summary_____

Log and Core_____

History_____

E-log_____

_____

Directional Survey_____

Other_____

(Check records for signature and correct name of operator or well, section, township, range, and field.)

Location_____ Notice states_____

_____

_____

_____

_____

Elevation_____ Notice states_____

_____

_____

_____

Production Reports_____

_____

(If production reports not received, make notation and inform Senior Stenographer when received.)

RECORDS & REQUIREMENTS CHECKED Engineer____

_____

_____

_____

_____

_____

_____

_____

Surface Inspection_____

Data Needed_____

Request Records_____ OGD170____

Correct records_____ OGD165____
(Specify)

EDP_____ (OGD42A-1, 2) ____

CARDS_____

BOND_____

Hold_____ Reason_____

Release____ Date Eligible_____ OGD150____

End premium year _____

Release requested _____ (Check One)

Bond superseded _____

Well abandoned _____

Environmental Inspection_____ Engineer____

FINAL LETTER_____ OG159____
and
File cleared _____ OGD121____

OGD2 (LONG BEACH)

Form OG.100 (7/78)

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
SEP 29 1986
WOODLAND, CALIFORNIA

04-077-20484

WELL SUMMARY REPORT

Operator	Well				
QUINTANA PETROLEUM CORPORATION	PIACENTINE #1-27				
Field	**County**	**Sec.**	**T.**	**R.**	**B.&M.**
Rio Blanco	San Joaquin	27	3N	5E	M.D.

Location (Give surface location from property or section corner, street center line and/or California coordinates)
3490' North along section line and 990' East at right angles to said line from the SW Corner of Section 27 (SE NE Section 27)

Elevation of ground above sea level
~ 6.5' GR

Commenced drilling (date)
7/4/86

Completed drilling (date)
7/9/86

Commenced producing (date)
Waiting on pipeline connection
☐ Flowing ☐ Pumping
☐ Gas lift

Name of producing zone(s)
Mokelumne

Total depth

(1st hole)	(2nd)	(3rd)
4900'		

Present effective depth
4856'

Junk

Depth measurements taken from top of:
☐ Derrick Floor ☐ Rotary Table ☒ Kelly Bushing
Which is 13' feet above ground

GEOLOGICAL MARKERS	DEPTH
T. Domengine Sd.	3790'
T. Capay	4570'
T. Mokelumne	4673'

Formation and age at total depth
Mokelumne, Cretaceous

	Clean Oil (bbl per day)	Gravity Clean Oil	Percent Water including emulsion	Gas (Mcf per day)	Tubing Pressure	Casing Pressure
Initial Production	(Test)		-0-	10 MMCFD	1635	2000
Production After 30 days						

CASING RECORD (Present Hole)

Size of Casing (API)	Top of Casing	Depth of Shoe	Weight of Casing	Grade and Type of Casing	New or Second Hand	Size of Hole Drilled	Number of Sacks or Cubic Feet of Cement	Depth of Cementing (if through perforations)
8 5/8"	Surface	627'	24#	K-55 ST&C 8Rd	New	12 1/4"	260	
5 1/2"	Surface	4900'	15.5#	K-55 LT&C 8Rd	New	7 7/8"	150	

PERFORATED CASING (Size, top, bottom, perforated intervals, size and spacing of perforation and method.)
4764'-4750' (LDT/CNL), 4" gun, 8 jspf

Was the well directionally drilled? If yes, show coordinates at total depth
☐ Yes ☒ No

Electrical log depths
CBL 4822'-3940', TDT 4814'-3800', CET 4816'-3950'

Other surveys
None

In compliance with Sec. 3215, Division 3 of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Name	Title	
J. M. Williams	Production Technician	
Address	**City**	**Zip Code**
1050 - 17th Street, Suite 400	Denver, Colorado	80265
Telephone Number	**Signature**	**Date**
(303)628-9211	J. M. Williams	9/26/86

SUBMIT IN DUPLICATE

SUBMIT IN DUPLICATE

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

Operator QUINTANA PETROLEUM CORPORATION Field or County San Joaquin County
Well PIACENTINE #1-27, Sec. 27, T 3N, R 5E, M.D.B. & M.
A.P.I. No. 04-077-20484 Name J. M. Williams (Person submitting report) Title Production Tech. (President, Secretary or Agent)
Date September 26, 19 86

Signature JMWilliams

1050 - 17th Street, Suite 400, Denver, Colorado 80265 (Address) (303)628-9211 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date

Please see attached detail sheets

OG103

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

No. T 686-185

DIVISION OF OIL AND GAS

Report on Operations

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Dr., Suite 133
Bakersfield, CA. 93309

Woodland Calif.
July9, 1986

Your operations at well "Piacentine" 1-27, API No. 077-20484,
Sec. 27, T.3N, R.5E, M.D.B.& M. --, Field, in San Joaquin County,
were witnessed on 7/5/86. R. Thesken, representative of
the supervisor, was present from 0500 to 0700. There were also present R. Bowles, Drilling Foreman.
Present condition of well: 8-5/8" cem. 625'. T.D. 628' (Standing cemented).

The operations were performed for the purpose of testing the blowout prevention equipment and installation.

DECISION: The blowout prevention equipment and its installation on the 8-5/8" casing are approved.

NOTE:

1. Deficiencies noted and to be corrected:

   a. Leak in hydraulic line to annular BOPE.

RT/sd

cc: Co., Denver, CO.

077 20484

M. G. MEFFERD

By John C. Sullivan RLH
John C. Sullivan

OG109 (3/83/GSR1/15M)

Gary #14

RLH

DIVISION OF OIL AND GAS

BLOWOUT PREVENTION EQUIPMENT MEMO

T _____

Operator Quintana Petroleum Well [illegible] Field _____ County San Joaquin

VISITS: Date / Engineer / Time / Operator's Rep. / Title

1st 7/5/12 — [illegible] — [illegible] to 0700 — B. Bowles — D.F.

2nd _____ — _____ — _____ to _____ — _____ — _____

Casing record of well: 8 5/8" cem 625' T.D. 648' (Standing cemented)

OPERATION: Testing (inspecting) the blowout prevention equipment and installation.

DECISION: The blowout prevention equipment and its installation on the 8 5/8 "casing are approved.

REQUIRED BOPE CLASS: III 2M

Proposed Well Opns: drill ahead MPSP: _____ psi

Hole size: 12 1/4 " fr. surface ' to 625 ' , _____ " to _____ ' & _____ " to _____ '

CASING RECORD (BOPE ANCHOR STRING ONLY)					Cement Details	Top of Cement	
Size	Weight(s)	Grade(s)	Shoe at	CP at		Casing	Annulus
8 5/8	44#	K-55	625		16 sx 'G' w/ 8% gel + 2% CaCl2 + ¼ lb/sk Flocele + 100 sx 'G' w/ 3% CaCl2		returns

BOP STACK							a	b	a/b	TEST DATA			
API Symb.	Ram Sz.	Mfr.	Model or Type	Size (in.)	Press. Rtg.	Date Last Overhaul	Gal. to Close	Rec.Time (Min.)	Calc. GPM Output	psi Drop to Close	Secs. to Close	Test Date	Test Press.
		Hyd	[illegible]		2000							7/5	1000
		"	"		✓							✓	1500
		"	"		✓					✓	comp	✓	1500

ACTUATING SYSTEM

Accum. Unit(s) Wkg. Press. 3000 psi

Total Rated Pump Output _____ gpm

Distance From Well Bore 201 ft.

	Mfr.	Accum. Cap.	Precharge
1	Koomey	80 gal.	1500 psi
2		gal.	psi

CONTROL STATIONS	Elec.	Hyd.
✓ Manif. at accum. unit		✓
✓ Remote at Drlr's. stn.	✓	
Other:		

EMERG. BACKUP SYST.	Press.	Wkg. Fl.
✓ N2 Cyl No: 6 Type:	1 2000	gal.
Other:	2 ✓	gal.
	3 ✓	gal.
	4	gal.
	5 ✓	gal.
	6 ✓	gal.

AUXILIARY EQUIPMENT

		No.	Sz. (in.)	Rated Press.	Connections Weld	Flan.	Thrd.
✓	Fill-Up Line						
✓	Kill Line						
✓	Control Valve(s)	1					
✓	Check Valve(s)						
✓	Auxil. Pump Connec.						
✓	Choke Line						
✓	Control Valve(s)						
✓	Pressure Gauge						
✓	Adjustable Choke(s)	1					
✓	Bleed Line						
✓	Upper Kelly Cock						
✓	Lower Kelly Cock						
✓	Standpipe Valve						
✓	Standpipe Pressure Ga.						
✓	Pipe Safety Valve						
✓	Internal Preventer						

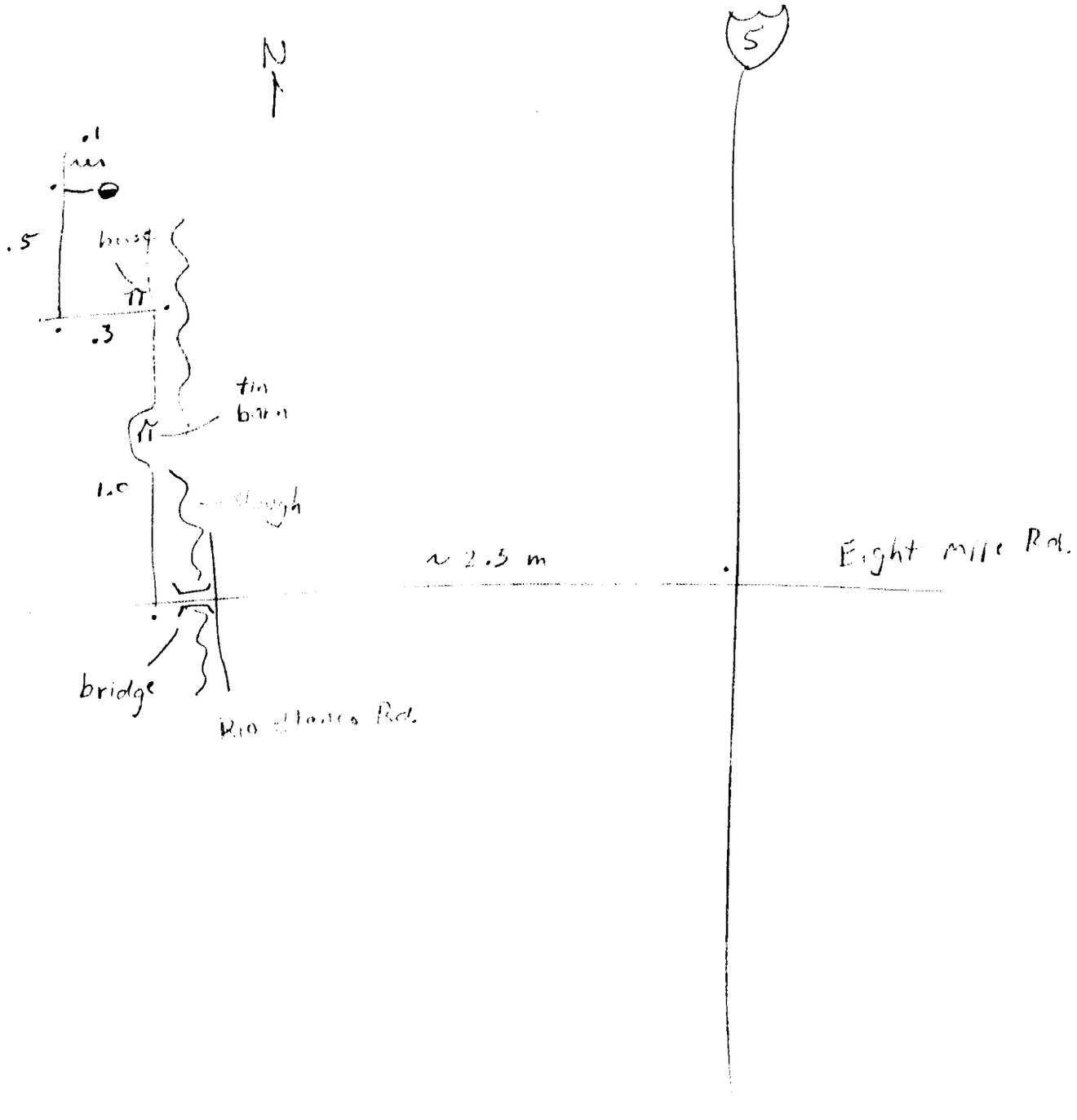
HOLE FLUID MONITORING EQUIPMENT	Aud.	Vis.
✓ Calibrated Mud Pit		
✓ Pit Level Indicator	✓	
Pump Stroke Counter		✓
✓ Pit Level Recorder		✓
Flow Sensor		
Mud Totalizer		
Calibrated Trip Tank		
Other:		

Class: A / B / C

REMARKS: Deficiencies
1) Leak in hydraulic line to annular BOPE

Hole Fluid Type	Weight	Storage Pits

OGD9 (10/84/DWRR/3M)


N
5
.1
.5
.3
tin
barn
1.0
~ 2.3 m
Eight mile Rd.
bridge

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

No. P 686-204

--
(field code)
--
(area code)
--
(new pool code)
--
(old pool code)

REPORT ON PROPOSED OPERATIONS

WELL CLASSIFICATION: Development

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA. 93309

Woodland, California
June 3, 1986

Your proposal to drill well "Placentine" 1-27,
A.P.I. No. 077-20484, Section 27, T. 3N, R. 5E, M.D. B. & M.,
-- field, -- area, -- pool,
San Joaquin County, dated 5/28/86, received 5/30/86 has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. The 8-5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.
2. The 5½" casing is cemented with sufficient cement to fill behind this casing from the shoe to at least 500 feet above the uppermost oil or gas zone.
3. Drilling fluid of a quality and in sufficient quantity to control all subsurface conditions in order to prevent blowouts is used.
4. Blowout prevention equipment conforming to Class III B 2M requirements is installed on the 8-5/8" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
5. Blowout prevention equipment conforming to Class "III" 2 M requirements is installed on the 5½" casing and maintained in operating condition at all times. See Manual M07 and attached sheet.
6. Water with any beneficial use is protected from contamination at all times.
7. The division is furnished copies of any draw down or back pressure tests performed. In addition the division will monitor the production for a period of six months and if anomalous water production is indicated, remedial action will be ordered.
8. THIS DIVISION IS NOTIFIED:
   a. Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.
   b. To witness a test of the installed blowout prevention equipment prior to drilling out the shoe of the 8-5/8" casing. The blind/blank rams shall be tested by the operator prior to calling the Division inspector. Test information of the blind/blank ram test shall be entered on the tour sheet along with the signature of the person in charge.

NOTE: 1. Information on file in this office indicates that the base of the useable fresh water deposits should be encountered at a depth of approximately 150'.

Blanket Bond
RLH/sd

cc: Co.

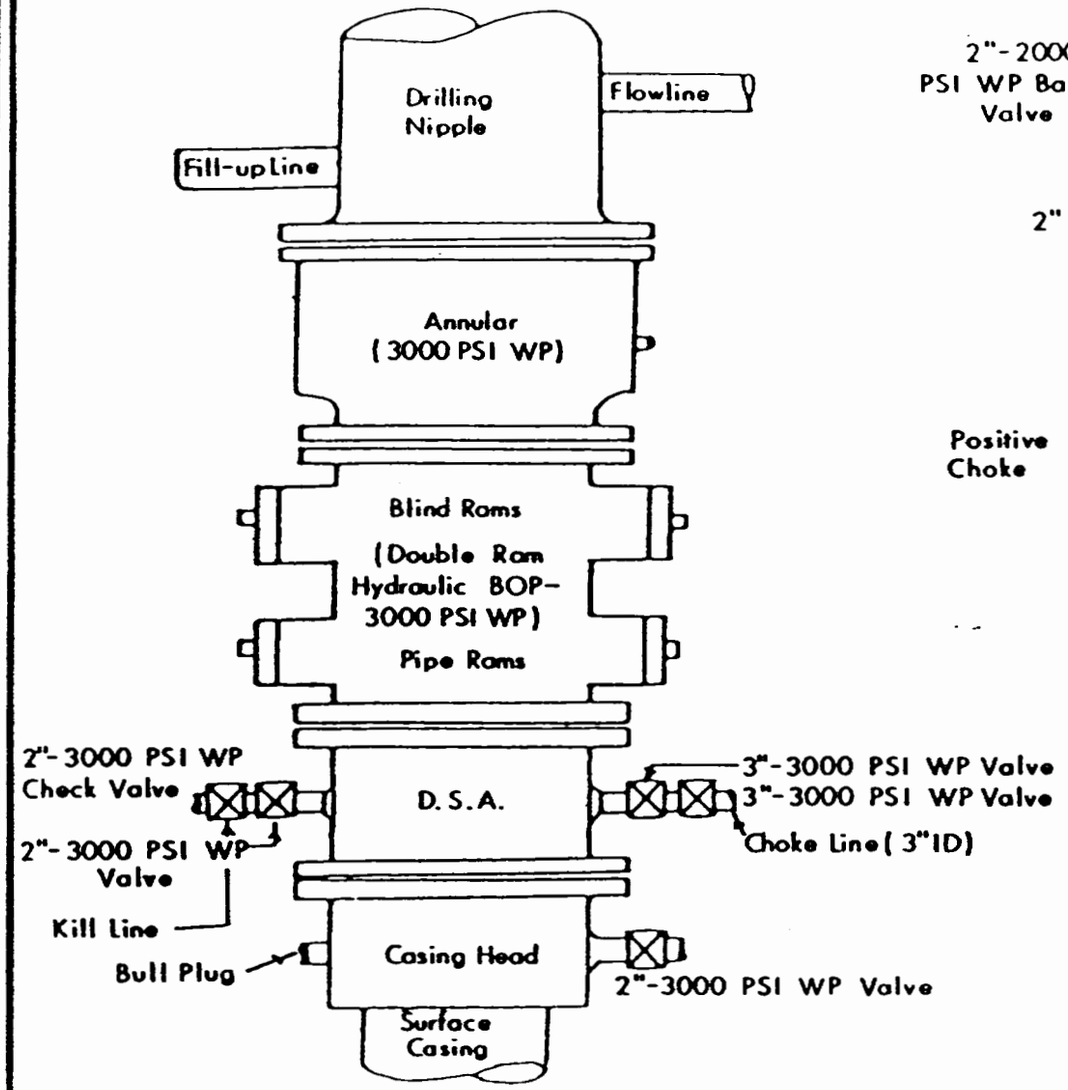
M. G. MEFFERD, State Oil and Gas Supervisor
By John C. Sullivan
Deputy Supervisor
John C. Sullivan

A copy of this report and the proposal must be posted at the well site prior to commencing operations.

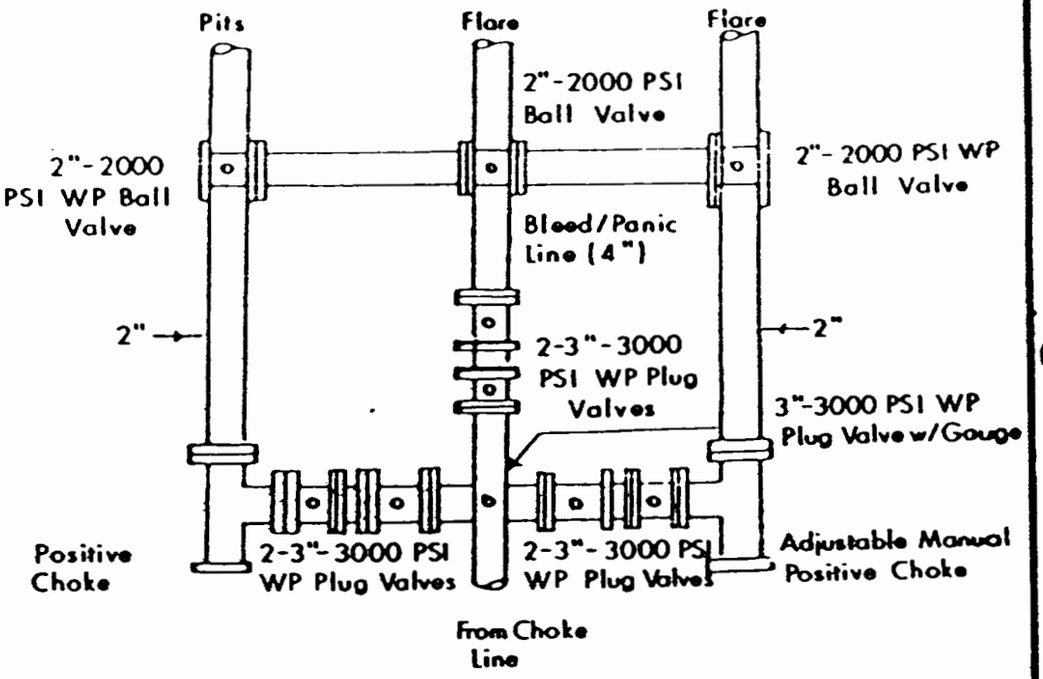
Records for work done under this permit are due within 60 days after the work has been completed or the operations have been suspended.

OG111 (11/82/DWRR/5M)

BOP SCHEMATIC
3000 PSI WORKING PRESSURE



PLAN VIEW CHOKE MANIFOLD



The hydraulic closing unit will be located more than 30' from the wellhead. Choke & bleed/panic lines will go to the pit and flare. All connections in choke line and manifold will be flanged or welded. All flanges should be ring joint gasket type. All turns in lines shall be constructed using targeted 90° tees or block ells. All lines shall be anchored.

Quintana *Denver, Colorado*

DIAGRAM #1

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS
117 WEST MAIN STREET, SUITE No. 11
WOODLAND, CALIFORNIA 95695
(916) 662-4683

June 2, 1986

James R. Weddle, Agent
QUINTANA PETROLEUM CORP.
1400 Easton Drive, Suite 133
Bakersfield, CA 93309

Re: QUINTANA PETROLEUM CORP.
"Piacentine" 1-27
Sec. 27, T. 3N., 5E.,
San Joaquin Co.

Dear Mr. Weddle:

This office is in receipt of your request of 5/28/86 regarding confidential status for the above well. The request is denied as the well is classified as a "Development" well. Assembly Bill 3002, which became effective January 2, 1985, restricts confidential status to "Exploratory" wells or "Development" wells where there are extenuating circumstances.

Sincerely,

JOHN C. SULLIVAN
Deputy Supervisor

JCS:cm
cc: John W. Wessels

QUINTANA PETROLEUM CORPORATION
1050 SEVENTEENTH STREET
SUITE 400
DENVER, COLORADO 80265
(303) 628-9211

RECEIVED
MAY 30 1986
WOODLAND, CALIFORNIA

May 28, 1986

State of California
Division of Oil & Gas
District No. 6
117 W. Main Street, Suite 11
Woodland, California 95695

RE: Piacentine #1-27
Section 27, T3N-R5E
San Joaquin County, California

Gentlemen:

We request that all information received in your office on the subject well be held confidential for the maximum time allowable. Thank you for your attention to this matter.

Very truly yours,

Jeannie Williams
Production Technician

/jw

No "OG" well
Colette Sand
Letter

71-08-22, 44

79077773

RECORDING REQUESTED BY

TENNECO OIL COMPANY

WHEN RECORDED MAIL TO

TENNECO OIL COMPANY

P.O. BOX 9909

BAKERSFIELD, CA 93309

ATTN: DIVISION PROPERTIES

COMPANY SHOWN

SPACE ABOVE THIS LINE FOR RECORDER'S USE

OIL, GAS AND MINERAL LEASE

(SHORT FORM)

THIS LEASE AND AGREEMENT, made and entered into August 30, 19 79

by and between EDWARD H. PIACENTINI and RITA HELEN PIACENTINI, His Wife,

hereinafter called "Lessor" (whether one or more), and TENNECO OIL COMPANY, a Delaware corporation, hereinafter called "Lessee,"

W I T N E S S E T H :

Lessor hereby grants and leases to Lessee and Lessee hereby leases from Lessor the land hereinafter described, for the purposes and with the exclusive right of prospecting, exploring, mining, drilling and operating said land for oil, gas, other hydrocarbons, associated substances, sulphur, nitrogen, carbon dioxide, helium and other commercially valuable substances which may be produced through wells on said land, whether or not similar to the above-mentioned substances. The land hereby leased is situated in

San Joaquin County, California, and is described as follows:

See EXHIBIT "A" attached hereto and by reference made a part hereof:

This lease is made for the term and upon and subject to each and all the terms, provisions, covenants and conditions set forth in the certain Oil, Gas and Mineral Lease of even date herewith between the parties hereto covering the land hereinabove described, and said Oil, Gas and Mineral Lease is hereby incorporated herein with the same force and effect as though herein set forth at length.

IN WITNESS WHEREOF, said parties have caused this lease to be duly executed as of the date first hereinabove written.

Edward H. Piacentini

Edward H. Piacentini

Rita Helen Piacentini

Rita Helen Piacentini

LESSOR

TENNECO OIL COMPANY

By

Attorney-in-Fact

LESSEE

SUBSCRIBING WITNESS

79077773

EXHIBIT "A"

PARCEL 1 OF CAMP 5:

COMMENCING at a point near the West end of the highway bridge crossing Bishop Cut, said point being marked by a railroad spike stamped R. E. 2909, Driven into the pavement of the G. A. Atherton Road No. 550; said point of commencement being South 88° 23' 30" West, 14,048.79 feet more or less, from the Southeast cornaer of Section 36, Township 3 North, Range 5 East, M. D. B. & M., thence running from point to point along the crown of the levee the following courses and distances North 0° 14' West, 1769.64 feet; North 1° 57' West, 389.90 feet; North 0° 43' West 479.10 feet; North 0° 43' West 2351.90 feet; North8° 47' East, 144.75 feet; North 25° 03' East 425.71 feet, more or less, to the point of beginning, said point of beginning being on the Easterly prolongation of the center line of the existing drainage ditch; thence running along the crown of the levee the following courses and distances: North 25° 03' East, 1177.33 feet; North 8° 41' East 106.58 feet; North 4° 16' West 1835.20 feet; North 19° 04' West 420.85 feet; North 37° 45' West 282.13 feet; North 59° 02' West 1049.15 feet; North 80° 16' West 218.20 feet; South 77° 05' West 843.23 feet to a point lying on the Northerly porlongation of the center line of the present drainage canal; thence, running along the prolonged center line of the present drainage canal, South 0° 38-1/2' East 4065.38 feet to the point of intersection with the prolonged center line of the existing drainage ditch; thence along the prolonged center line, North 88° 18' 10" East 1823.99 feet, more or less, to the point of beginning.

PARCEL 2:

A STRIP of land lying between the Easterly and the Northerly boundaries of Parcel 1 and the outer toe of the levee.

PARCEL 3:

A STRIP of land lying between the Easterly and Northerly boundaries of Parcel 2 (the outer toe of the levee along the Westerly side of Bishop Cut and the Southerly side of White Slough) and a line parallel to and 200 feet Easterly from the outer toe of the levee along Bishop Cut and the center line of White Slough.

End of Description

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS
Notice of Intention to Drill New Well

DIVISION OF OIL AND GAS
RECEIVED

C.E.Q.A. INFORMATION			
EXEMPT ☐ CLASS ____	NEG. DEC. ☐ S.C.H. NO. ____	E.I.R. ☐ S.C.H. NO. ____	DOCUMENT NOT REQUIRED BY LOCAL JURISDICTION ☒
See Reverse Side			

FOR DIVISION USE ONLY					
MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
610	pr 6/1/88	VV	BB	✓	✓

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well Piacentine #1-27, well type Gas, API No. 077-20484 (Assigned by Division)

Sec. 27, T. 3N, R. 5E, M.D.B. & M., ~~Wildcat~~ Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 212.30 acres, is as follows: map attached (Attach map or plat to scale)

(see attached legal description)

Do mineral and surface leases coincide? Yes X No ____. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 3490 feet North (Direction) along section / ~~property~~ (Cross out one) line and 990 feet East (Direction)

at right angles to said line from the Southwest corner of section / ~~property~~ (Cross out one) 27 or

Is this a critical well according to the definition on the reverse side of this form? Yes ☐ No ☒

If well is to be directionally drilled, show proposed coordinates (from surface location) at total depth:
N/A feet (Direction) and ____ feet (Direction)

Elevation of ground above sea level -6.5 feet. See letter of 2/4/88

All depth measurements taken from top of Kelly Bushing that is ±10' feet above ground.
(Derrick Floor, Rotary Table, or Kelly Bushing)

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES API	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS	CALCULATED FILL BEHIND CASING (Linear Feet)
		SEE ATTACHED DRILLING PROGNOSIS				

(A complete drilling program is preferred and may be submitted in lieu of the above program.)

Intended zone(s) of completion Mokelumne (Name, depth, and expected pressure) Estimated true vertical depth 4900'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Name of Operator	Type of Organization (Corporation, Partnership, Individual, etc.)	
QUINTANA PETROLEUM CORPORATION	Corporation	
Address	**City**	**Zip Code**
1050 - 17th Street, Suite 400	Denver, Colorado	80265
Telephone Number / **Name of Person Filing Notice**	**Signature**	**Date**
(303)628-9211 J. M. Williams	J M Williams	5/28/86

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

OG105 (9/83/GSR1/5M)

Information for compliance with the California Environmental Quality Act of 1970 (C.E.Q.A.).

If an environmental document has been prepared by the lead agency, please submit a copy of the document with this notice *or* supply the following information:

Lead Agency: San Joaquin County Planning Department

Lead Agency Contact Person: Planning Staff

Address: 1810 East Hazelton

Stockton, California 95205

Phone: (209) 944-3722

FOR DIVISION USE ONLY
District review of environmental document (if applicable)? Yes ☐ No ☐
Remarks:

CRITICAL WELL

As defined in the California Administrative Code, Title 14, Section 1720(a), "Critical well" means a well within:

(1) 300 feet of the following:
(A) Any building intended for human occupancy that is not necessary to the operation of the well; or
(B) Any airport runway.
(2) 100 feet of the following:
(A) Any dedicated public street, highway, or nearest rail of an operating railway that is in general use;
(B) Any navigable body of water or watercourse perennially covered by water;
(C) Any public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or
(D) Any officially recognized wildlife preserve.

Exceptions or additions to this definition may be established by the supervisor upon his own judgment or upon written request of an operator. This written request shall contain justification for such an exception.

BFU 1501-14

AFE #56603

QUINTANA PETROLEUM CORPORATION

SHEET A

DRILLING RECORD

PAGE NO. 1

LEASE PIACENTINE WELL NO. #1-27
FIELD KING ISLAND
LOCATION 3490' FSL & 990' FWL
Section 27, T3N-R5E
San Joaquin County, California

PERMIT NO. _____ API NO. 077-20484
T.D. 4900' T.V.D. 4900'
DEVIATION (B.H.L.) Not directionally drilled
COMPANY ENGINEER O. Duncan, Consultant

SPUD DATE 7/4/86 DATE 7/23/86
CONTRACTOR Gary Drilling RIG NO. D-14
TYPE UNIT Rotary Rig
DRILL PIPE DESCRIPTION 14" FH 14.#

ELEVATIONS: GROUND 6.5 MSL
CASING HEAD 5. MSL
TUBING HEAD 7 MSL
ROTARY DRIVE BUSHING 18.5 MSL

APPROVED T. Scott Simbeck

BIT RECORD

DATE	In DEPTH	BIT NO.	SIZE	MAKE	TYPE	JET SIZE	DEPTH OUT	FEET	HOURS	COND. T/B/G/	FT./HR.	DEPTH & DEVIATION VERTICAL ☐ DIRECTIONAL ☐
7/4	52'	1A	12 1/4	Reed	Y11J	2/16 1/14	628'	576'	6 1/2	3-4-1	88.6	1/4° @ 292' 1/2° @ 628'
7/5	628'	1	7 7/8	Smith	FDS	3-10	3102'	2475'	19	5-6-1	130	3/4° @ 1140' 3/4° @ 1899' 3/4° @ 2998'
7/6	3102'	2	7 7/8	Reed	HP11	3/9 1/10	4294'	1192'	13 3/4	7-5-1	86.7	1/2° @ 3665'
7/7	4294'	3	7 7/8	Reed	HP11	3-9	4900'	606'	7 1/2	7-5-1	80.8	1/2° @ 4900'

AFE #56603

SHEET B

PAGE NO. 1

QUINTANA PETROLEUM CORPORATION

MUD RECORD

LEASE PIACENTINE WELL NO. #1-27 FIELD

TYPE DISTRIBUTOR GEO WESTERN

DATE	DEPTH	WEIGHT	VISC.	W.L.	PH	SALT	OIL	SAND	SOLIDS	REMARKS
7/4	354'	9.3	50	n/c	n/c	n/c	0	-	-	
7/5	628'	9.2	38	-	-	-	-	-	-	
7/6	3102'	9.3	37	6.2	8.5	500	0	1/4	7	
7/7	4294'	9.6	37	6.4	8.5	550	0	1/4	9	
7/8	4900'	9.5	35	7.0	8.5	450	0	1/4	8	
7/9	4900'	9.4	35	7.0	8.5	400	0	1/4	8	

AFE #56603

SHEET C

PAGE NO 1

QUINTANA PETROLEUM CORPORATION

WELL RECORD

LEASE PIACENTINE WELL NO. #1-27 FIELD _____

CASING & TUBING RECORD

SIZE	WEIGHT	THREAD	GRADE	DEPTH	REMARKS
8 5/8	24#	ST&C 8Rd	K-55	627'	Cem. w/260 sxs. "G"
5 1/2	15.5#	LT&C 8Rd	K-55	4900'	Cem. w/150 sxs. "G"

PERFORATING RECORD

DATE	INTERVAL	P.T.D.	REASON	PRESENT CONDITION
7/22	4750-4764'		Production	Open.

INITIAL PRODUCTION

DATE	INTERVAL	NET OIL	CUT	GRAV.	C.P.	T.P.	CHOKE	MCF	GOR	REMARKS
7/24	4750'-4764'	---	---	---	2000	1635	14/64"	10,000	---	Test

WELL HEAD ASSEMBLY

TYPE: _____

CASING HEAD: 11" x 3M# x 8 5/8" SW w/BP and Gray gate valve

CASING HANGER: 11" x 5 1/2" Casing Slips & Seal Assembly

CASING SPOOL: _____

TUBING HEAD: 11" 3MP x 7 1/6" w/ 1 2 1/16" WK Gate Valve

TUBING HANGER: _____

TUBING HEAD TOP: _____

MASTER VALVES: _____

CHRISTMAS TREE TOP CONN.: _____

SALEM CO FORM NO 1960

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

PAGE NO. 1

AFE #56603

LEASE PIACENTINE WELL NO. 1-27 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
		Location: 990' E & 3490' N of SW corner of projected Section 27, T3N-R5E San Joaquin County, California
7/4/86	354'	Day 1. Drld 302', drlg, clay and sd, MW 9.3, vis 50. Survey: ¼° @ 292'. MIRU Gary Drilling Rig D-14. SPUD at 2401 hrs 7/4/86. Drld and surveyed to 292'. POOH for plugged bit, drld to 354', NDA. DC: $9295 CTD: $9295
7/5/86	628'	Day 2. Drld 274', testing BOPE, sd and clay, MW 9.2, vis 38. Survey: ½° @ 628'. Drld to 628', made wiper trip to surface, circ and cond mud. POOH. Ran 16 jts 8 5/8" csg and set at 627'. Cmt w/BJ/Titan using 160 sx class "G" cmt + 8% gel + 3% $CaCl_2$ and 100 sx class "G" cmt + 3% $CaCl_2$. Total slurry volume 461 cu ft (75% excess). PD at 1348 hrs 7/4/86 w/1000 psi. Release press and float held OK. Had 100 cu ft clean cmt returns (22% excess). Ran 4 centralizers: 1 - 10' above shoe, 1 on each of next 3 collars. WOC, weld on csg head and test, NU BOPE and test, test witnessed by D.O.G. representative. DC: $30,409 CTD: $39,704
7/6/86	3102'	Day 3. Drld 2475', circ for TFNB, sd and clay, MW 9.3, vis 37, WL 6.2. Surveys: 3/4° @ 1140', 1899' and 2998'. Drl out insert, cmt and shoe. Drld and surveyed to 3102', now prep to TFNB. DC: $9957 CTD: $49,661
7/7/86	4294'	Day 4. Drld 1192', drlg, sd and clay, MW 9.6, vis 37, WL 6.4. Survey: ½° @ 3665'. TRNB, drld to 3665', wipe hole to 2840', drld to 4294', TFNB. DC: $7788 CTD: $57,449 Formation tops: Deadhorse at 3590' Domengine at 3793'
7/8/86	4900'	Day 5. Drld 606', TIH, sd and clay, MW 9.5, vis 35, WL 7.0. Survey: ½° @ 4900'. Drl to 4900'. Circ, wiper trip, strap DP. TIH. Circ and cond for logs, TOOH, log, TIH. DC: $15,190 CTD: $72,639
7/9/86	TD 4900'	Day 6. Drld 0', running csg, MW 9.4, vis 35, WL 7.0. TIH, circ and cond, WO csg, LD DP and DC's, now running 5½" csg. DC: $24,710 CTD: $97,349
7/10/86	TD 4900'	Day 7. Ran 124 jts 5½" csg, set at 4900.00'. Circ 3/4 hr, cmt w/BJ Titan using 300 gal weighted mud sweep followed by 150 sx Class G containing 10% salt, 0.75% CD-31, 0.2% FP-8. Displace w/115.6 bbls fresh wtr. Total slurry volume - 174 cu ft, weight 16.0 ppg, yield 1.16 cu ft/sk. Bump plug w/1250 psi. Release press, float held OK. PD at 1030 hrs 7/9/86 PDT. Good returns throughout. Set slips, ND BOPE, install tbg head, clean mud tanks. Rig released at 2300 hrs 7/9/86. Now WO completion. DC: $38,456 CTD: $135,805
7/18/86	4858'	RU Welex and run CBL. LTD at 4824'. DTD at 4858'. Log 4822'-3940'. Excellent bond. Cmt top at 4175'. RD Welex.
7/19/86	4858'	RU Schlumberger. Run TDT log 4814'-3800'. LTD at 4822'. Run CET log from 4816'-3950'. LTD at 4822'. No channeling indicated by CET. RD Schlum.
7/20/86	4858'	Shut down - will MI rig Monday.
7/21/86	4858'	Shut down - will MI rig today.

SALCM CO. FORM NO 1868

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

PAGE NO. 2

AFE #56603

LEASE PIACENTINE WELL NO. 1-27 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
	PBTD	
7/22/86	4856'	Day 1. MIRU Weltech Rig #246. NU BOPE and tested to 2000 psi, TIH w/bit and scraper. Tagged cmt top at 4846'. RU swivel and drld cmt stringers to 4856', SDFN. DC: $11,951 CTD: $147,756
7/23/86	4856'	Day 2. Circ out w/9.4 ppg brine. POOH w/bit and scraper. RU Welex. Press test lubricator to 2000 psi, TIH w/4" csg gun and perf Mokelumne Sd from 4749'-63' w/8 JSPF (CET 7/18/86) = 4750'-64' (LDT/CNL). RD Welex. RIH w/Baker R-3 pkr and "F" nipple and tbg setting, set pkr at 4702' w/1200#. ND BOPE, NU tree. RU swab equip, tag fluid at 100' down. Pulled from 1200', well came in and flowed 31 BW to rig tank. Well clean, SIFN. DC: $25,288 CTD: $173,044
7/24/86	4856'	Day 3. RDMO rig. RU tester, SITP 1850 psi. Opened well and tested on 5 MMCFPD rate for 4 hrs. Attempted to raise rate to 10 MMCFPD, separate burst plate blew. Working on test separator. SITP 1850 psi. DC: $6680 CTD: $179,724
7/25/86	4856'	Day 4. Flowed well at ±10 MMCFD and 1635 psig tbg press for 4 hours. SI well - press immediately built to 1860 psig. After 35 min SITP 1848 psig. Prod .1 bbl wtr (chlorides = 49,000 ppm). Will pull bombs at 1100 hrs today. DC: $8,000 CTD: $187,724 FINAL REPORT.
7/28/86		Correction to final cost to date: $220,415

SALCH CO. FORM NO. 1948

QUINTANA PETROLEUM CORPORATION

DRILLING RECORD

SHEET D

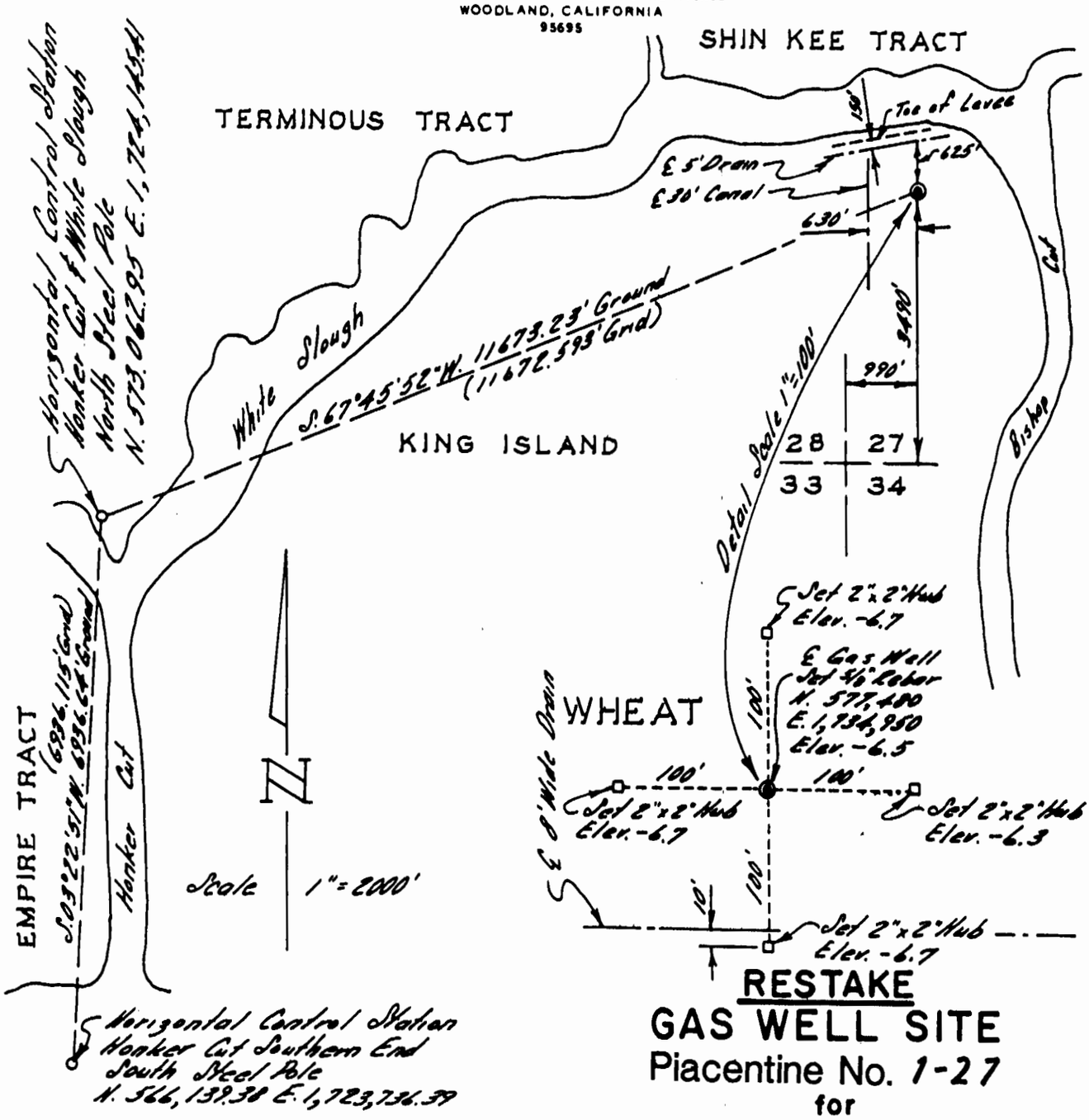
PAGE NO. 3

AFE #56603

LEASE PIACENTINE WELL NO. 1-27 FIELD

DATE	E.T.D.	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS
7/5/86		**8 5/8" Casing Detail**
		1 Baker 8 5/8" guide shoe ..... 1.15'
		1 jt 8 5/8" 24# K-55 ST&C 8rd R-3 casing ..... 39.79'
		1 Baker 8 5/8" insert float valve ..... 0.00'
		15 jts 8 5/8" 24# K-55 ST&C 8rd R-3 casing ..... 589.12'
		Total casing run ..... 630.06'
		Casing cut off ..... 16.28'
		Casing in hole ..... 613.78'
		Distance RKB to head ..... 13.15'
		Casing set at ..... 626.93'
7/10/86		**5 1/2" Casing Detail**
		1 Baker guide shoe ..... 0.90'
		1 jt 5½" 15.5# K-55 8rd LT&C R-3 casing ..... 39.71'
		1 Baker DFFC ..... 1.72'
		123 jts 5½" 15.5# K-55 8rd LT&C R-3 casing ..... 4864.25'
		Total casing run ..... 4906.58'
		Casing cut off ..... 19.73'
		Casing in hole ..... 4886.85'
		RKB to CHF ..... 13.15'
		Casing set at ..... 4900.00'
		Centralizers (turbolizers) at 4885', 4805', 4765', 4726', 2687', 4648'.
		2 7/8" Tubing Detail
		1 2 7/8" muleshoe..... .88'
		1 2 7/8" Model R double grip packer ..... 7.18'
		1 jt 2 7/8" 6.5# J-55 tubing ..... 31.14'
		1 2 7/8" F Nipple (I.D. 2.31)..... .97'
		152 jts 6.5# J-55 tubing ..... 4648.17'
		1 tubing hanger ..... .80'
		Total tubing and equipment ..... 4689.14'
		Distance RKB to hanger ..... 13.00'
		Effective tubing setting ..... 4702.14'

YOLO ENGINEERS & SURVEYORS, INC.
WOODLAND PH. 662-4346 • DAVIS PH. 753-2515 • WEST SACTO PH. 371-7076
Post Office Box 1364 1216 Farma Avenue
WOODLAND, CALIFORNIA
95695



NOTE:
Coordinates based on California State Coordinate System Zone III

J. E. Joyce
R.C.E. 16698 Lic. expires 6-30-89

RESTAKE
GAS WELL SITE
Piacentine No. 1-27
for
QUINTANA PETROLEUM
on
KING ISLAND
Projected T. 3N. R. 5E.
M.D.B. & M.
San Joaquin County, California
May 21, 1986

DRILLING PROGNOSIS
QUINTANA PETROLEUM CORPORATION
Piacentine #1-27
Rio Blanco Prospect
San Joaquin County, California

LOCATION:	990' E & 3490' N of SW corner of projected Section 27, T3N-R5E San Joaquin County, California
PROPOSED TOTAL DEPTH:	4900'
ESTIMATED FORMATION TOPS:	Deadhorse Sand 3590' Domengine 3800' Capay 4590' Mokelumne 4685'
CONTRACTOR:	Not selected at this time.
MUD PROGRAM:	Vendor not selected at this time.

PROPOSED PROGRAM:

Depth:	0'-600'	600'-2500'	2500'-TD
Mud Type:	Spud mud	Gel/Lime	LSND
Mud Weight:	8.8-9.0	8.8-9.3	8.8-9.8
Viscosity:	30-40 sec	30-40 sec	35-45 sec
Fluid Loss:	NC	NC	6-10 cc

CONDUCTOR CASING: 16", set at +/-40'.

SURFACE CASING: 8 5/8" 24# K-55 ST&C set at +/-600'. ✓

CEMENT PROGRAM: Surface Cement: 220 sx class G cement with 8% gel and 3% CaCl2 followed by 150 sx class G with 3% CaCl2. If cement does not circulate to surface use 1" to top out.

Float Equipment: Guide shoe, insert float, four centralizers and a limit clamp. Run centralizers 10' above shoe, insert collar, and next two collars above insert float.

Production Casing Cement: Volumes and slurry designs will be provided after inspection of open hole logs.

PRODUCTION CASING: 5 1/2" 15.5# K-55 ST&C set at 4900'.

LOGGING PROGRAM: Log well at TD. Service company to be selected. Tentative program is as follows:

DIL-GR-SP - TD to BSC
BHC-Sonic-GR - TD to BSC
*FDC-CNL-GR-Cal - Minimum run

*Check with Engineering Department prior to running the FDC-CNL log.

DRILL STEM TESTS: None scheduled at this time.

DEVIATION SURVEYS:

Depth	Max. Dev.	Max. Rate of Change	*Survey Intervals
0'-600'	1 deg	1 deg/100'	300'
600'-TD	5 deg	1 deg/100'	1000'

*Survey intervals will be based on severity of hole angle, but not to exceed 300' in surface hole and 1000' from BSC to TD.

SPECIAL EQUIPMENT:

1. Manned mud logging unit fully operational from 2500' to total depth. Vendor to be selected.
2. Totco single shot deviation tool (drift only).
3. TIW and inside BOP to bit drill pipe with crossovers to fit drill collars on floor at all times.
4. Have Flo-Sho operational from spud.

HOLE SIZE: 12 1/4" - (0' - 600')
7 7/8" - (600'- TD)

CUTTING SAMPLES: Every 30' from base of surface casing to 4900' (1 set paleo and 1 set dry). Hold at rig.

CONSULTING GEOLOGIST: To be selected. To be on well at total depth.

WELLHEAD EQUIPMENT: Casing Head: Surface sales 8 5/8" OD SW x 11" 3M casing head with 2" 125 psi ball valve and no VR plug/nipple. Located at Surface Sales, Isleton, California - (916) 777-5133. Starter head will be rented and purchased if well is productive.

DRILLING PROCEDURE:

1. Perform rig inspection, and make corrections as needed, prior to spud. Drill and survey 12 1/4" hole to +/-600'. Make conditioning trip to surface. Circulate hole clean prior to pulling out of hole.

2. RU casing crew and run 8 5/8" casing to +/-600' KB. Circulate and condition mud prior to cementing.

3. Cement casing as specified in cement program. Reciprocate pipe +/-15' while cementing until cement returns observed, or until pipe starts to drag. DO NOT reciprocate pipe where casing collar could stop in head if casing stuck off bottom. Should float fail to hold, pressure back up to final pump pressure and hold. Use Class G Neat plus 3% CaCl2 or pea gravel if cement falls in annulus.

4. Wait on cement 4 hours. Install casing head. Test welds to 50% of casing collapse. Install BOPE and Flo-Sho equipment. Have Flo-Sho operational prior to drilling below surface casing. Test all BOPE to W.P. rating except annular. Test annular to 75% of rated W.P. Test casing to 1000 psi (minimum). Notify D.O.G. of BOPE test prior to testing.

5. Wear bushing not needed.

6. Rig up mudlogger at 2500'.

7. Drill 7 7/8" hole to total depth.

8. Conduct operational checks of BOPE daily and/or before trips and note on IADC report. Follow D.O.G. regulations for other BOPE test requirements as outlined on drilling permit.

9. At TD, circulate and condition mud, short trip as directed, and trip out of hole to log. KEEP HOLE FULL.

10. AT TD, log as specified herein or as directed.

11. Complete with 5 1/2" casing or plug and abandon as directed.

DDW:jp
3/27/86

PHONE NUMBERS:

NAME	HOME	OFFICE
Scott Kimbrough (Denver)	(303) 969-9468	(303) 628-9211
John Wessels (Denver)	(303) 987-0540	(303) 628-9211
Lee Knudtson (Denver)	(303) 234-0797	(303) 628-9211
J. M. Trotter (Houston)	(713) 580-2417	(713) 651-8639
C. M. Frick (Houston)	(713) 469-2917	(713) 651-8634

*Division of Oil and Gas (916) 662-4683
District #6 Office
Woodland, California
Mr. Bob Hauser, Engineer

*Verbal notification required:

1. Prior to testing BOPE and surface casing shoe and before drilling out.

2. Prior to plugging.

QUINTANA PETROLEUM CORPORATION
1050 SEVENTEENTH STREET
SUITE 400
DENVER, COLORADO 80265
(303) 628-9211

...SION OF OIL AND G.
RECEIVED
FEB 8 1988
WOODLAND, CALIFORNIA

February 4, 1988

State of California
Division of Oil & Gas
District No. 6
211 West Court Street, Suite #1
Woodland, California 95695

Attention: Mr. Rob Hauser

RE: Piacentine #1-27
SE NE Section 27, T3N-R5E
San Joaquin County, California

Dear Rob:

Per our conversation today, it has come to my attentionthat the elevations submitted on the Notice of Intention to Drill, as well as all subsequent forms, logs, etc., are incorrect. Please note the correct information listed below and change your records accordingly.

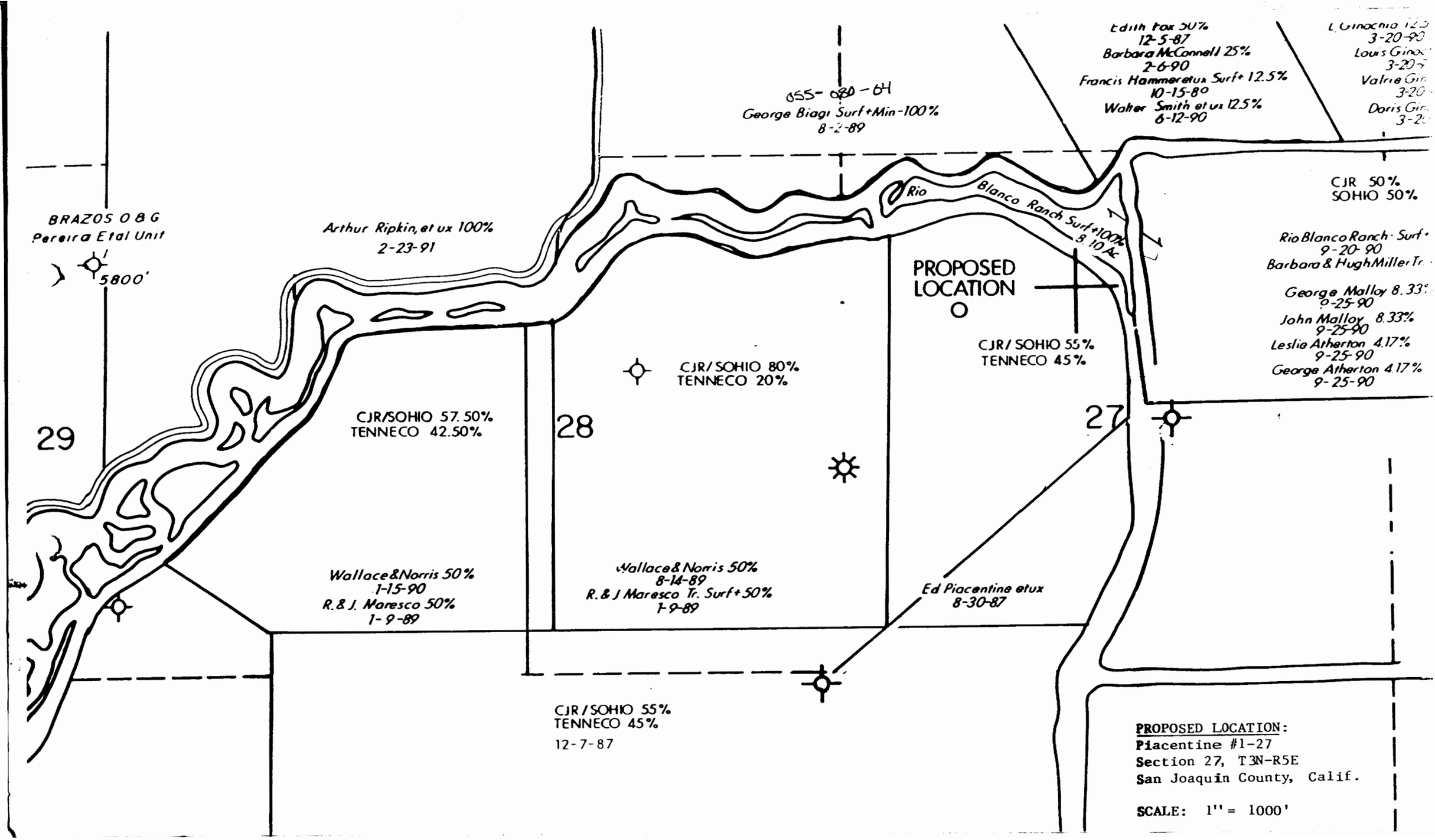
Ground Elevation: -6.5'
K.B.: 6.65'

Please call if you require further information.

Very truly yours,

Jeannie Williams
Production Technician

/jw
cc: Quintana - Houston
Standard Oil Production Co.
Tenneco Oil Company
Jim Tasker
Jim Weddle


Edith Fox 50%
12-5-87
Barbara McConnell 25%
2-6-90
Francis Hammeretux Surf+ 12.5%
10-15-80
Walter Smith et ux 12.5%
6-12-90
055-080-04
George Biagi Surf+Min-100%
8-2-89
CJR 50%
SOHIO 50%
Rio Blanco Ranch Surf+100%
8.10 Ac
Rio Blanco Ranch Surf+
9-20-90
Barbara & Hugh Miller Tr
George Malloy 8.33%
9-25-90
John Malloy 8.33%
9-25-90
Leslie Atherton 4.17%
9-25-90
George Atherton 4.17%
9-25-90
BRAZOS OBG
Pereira Etal Unit
5800'
Arthur Ripkin, et ux 100%
2-23-91
PROPOSED
LOCATION
CJR/SOHIO 55%
TENNECO 45%
CJR/SOHIO 80%
TENNECO 20%
CJR/SOHIO 57.50%
TENNECO 42.50%
29
28
27
Wallace&Norris 50%
1-15-90
R.&J. Maresco 50%
1-9-89
Wallace&Norris 50%
8-14-89
R.&J Maresco Tr. Surf+50%
1-9-89
Ed Piacentine etux
8-30-87
CJR/SOHIO 55%
TENNECO 45%
12-7-87
PROPOSED LOCATION:
Piacentine #1-27
Section 27, T3N-R5E
San Joaquin County, Calif.
SCALE: 1" = 1000'

INDUCTION ELECTRICAL LOG

Company SOUTH ATLANTIC OIL CORPORATION
Well SOUTH ATLANTIC OIL CORP. #1 JOHN DOE
Field WILDCAT
County LOS ANGELES State CALIFORNIA
Location 1320' S. & 1320' W. OF NE CORNER
Sec. 10 Twp. 1 S Rge. 1 W
Permanent Datum GROUND LEVEL Elev. 0
Log Measured From KELLY BUSHING 10 Ft. Above Perm. Datum
Drilling Measured From KELLY BUSHING

Date	10-15-51		
Run No.	ONE		
Depth-Driller	5000		
Depth-Logger	5000		
Bottom Logged Interval	5000		
Top Logged Interval	1000		
Type Fluid in Hole	MUD		
Salinity, P.P.M. Cl	1000		
Density	10.0		
Level	FULL		
Max. Rec. Temp. °F	120		
Operating Rig Time	12 HRS.		
Recorded By	J. SMITH		
Witnessed By	H. JONES		

Run No.	Bit From	Bit To	Size	Type Bit	Size From	Size To	Wt.	Type Fluid	Visc.	Fluid Loss
ONE	0	1000	12 1/4		0	1000	10.0	MUD	40	10
ONE	1000	5000	7 7/8		1000	5000	10.0	MUD	40	10

Run No.	Type Log	Depth-Driller	Depth-Logger	Bottom Logged Interval	Top Logged Interval	Scale Up Hr. - Min.
ONE	INDUCTION	5000	5000	5000	1000	1 HR.

Run No.	Max. Rec. Temp. °F	Equip. No. & Location	Recorded By	Witnessed By
ONE	120	1234 LOS ANGELES	J. SMITH	H. JONES

Run No. ONE
Type Log INDUCTION
Depth-Driller 5000
Depth-Logger 5000
Bottom Logged Interval 5000
Top Logged Interval 1000
Type Fluid in Hole MUD
Salinity, P.P.M. Cl 1000
Density 10.0
Level FULL
Max. Rec. Temp. °F 120
Operating Rig Time 12 HRS.
Recorded By J. SMITH
Witnessed By H. JONES

Run No. ONE
Bit From 0
Bit To 1000
Size 12 1/4
Type Bit
Size From 0
Size To 1000
Wt. 10.0
Type Fluid MUD
Visc. 40
Fluid Loss 10

Run No. ONE
Bit From 1000
Bit To 5000
Size 7 7/8
Type Bit
Size From 1000
Size To 5000
Wt. 10.0
Type Fluid MUD
Visc. 40
Fluid Loss 10

Run No. ONE
Type Log INDUCTION
Depth-Driller 5000
Depth-Logger 5000
Bottom Logged Interval 5000
Top Logged Interval 1000
Scale Up Hr. - Min. 1 HR.

Run No. ONE
Max. Rec. Temp. °F 120
Equip. No. & Location 1234 LOS ANGELES
Recorded By J. SMITH
Witnessed By H. JONES

FORM 159

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

REPORT OF WELL ABANDONMENT

Woodland, California

February 20, 1973

Mr. Charles W. Hatten, Agent
GREAT BASINS PETROLEUM CO.
1011 Gateway West, Century City
Los Angeles, CA 90067

DEAR SIR:

Your report of abandonment of Well No. "Rio Blanco" 1 (077-20172), Sec. 27, T. 3N, R. 5E, M.D. B. & M., -- field, San Joaquin County, dated Nov. 13,1972, received Feb. 15, 1973, has been examined in conjunction with records filed in this office.

A review of the reports and records shows that the requirements of this Division, which are based on all information filed with it, have been fulfilled.

Blanket Bond
RJ:rmc

JOHN F. MATTHEWS, JR.
State Oil and Gas Supervisor

By R. M. Barger
Deputy Supervisor

Great Basin Petroleum Co.
"Rio Blanco" 1
Sec. 27, T. 3N, R. 5E
San Joquin Company.

RECORDS RECEIVED		STATUS	DATE
Date Received		Producing - Oil	
Well Summary (Form 100)	11/29/72	Idle - Oil	
History (Form 103)	11/29/72	Abandoned - Oil	
Core Record (Form 101)		Drilling - Idle	
Elec. Log - Lge. 2 Small		Abandoned - Dry Hole	Oct. 18, 1972
Direct. Survey		Producing - Gas	
Sidewall Samples		Idle - Gas	
Other Mud log - 1		Abandoned - Gas	
		Gas - Open to Oil Zone	
Notice of Records Due Form 170		Water Flood Source	
		Water Disposal	
Date Final Records Received		Water Flood	
		Steam Flood	
		Fire Flood	
		Air Injection	
		Gas Injection	
		CO_2 Injection	
		LPG Injection	
		Observation	

RECOMPLETED

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.) ✓
2. Electric Log ✓
3. Operator's Name ✓
4. Signature ✓
5. Well Designation ✓
6. Location ✓
7. Elevation ✓
8. Notices ✓
9. "T" Reports ✓
10. Casing Record ✓
11. Plugs
12. Surface Inspection
13. Production

CLERICAL CHECK LIST

1. Location change ___ (F-165)
2. Elevation change ___ (F-165)
3. Form 121 ✓
4. Form 159 (Final Letter) Yes
5. Form 150b (Release of Bond) Yes

(077-20172)

RECORDS NOT APPROVED
Reason:

RECORDS APPROVED

RELEASE BOND
Date Eligible
(Use date last needed records were received.)

MAP & MAP BOOK

FORM 19

FORM 100

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

WELL SUMMARY REPORT

SUBMIT IN DUPLICATE

DIVISION OF OIL AND GAS
RECEIVED
NOV 29 1972
WOODLAND, CALIFORNIA

Operator GREAT BASINS PETROLEUM CO. Well No. Rio Blanco - 1

Sec. 27, T. 3 N., R. 5 E., M. D. B. & M. - - - Field San Joaquin County.

Location 2700 feet South and 2000 feet West from projected Northeast corner projected section 27
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level - 5 feet.

All depth measurements taken from top of Kelly Bushing which is 11.0 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

In compliance with Sec. 3215, of the Public Resources Code, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Date November 13, 1972 Signed Charles W. Hatten
Charles W. Hatten

R. O. Stein, Jr. (Engineer or Secretary) (Superintendent) Title President
(President, Secretary or Agent)

Commenced drilling October 14, 1972

Completed drilling

Total depth 5450' Plugged depth 557 - 360'

Junk NONE " " 40 - 15'

GEOLOGICAL MARKERS | DEPTH

Geologic age at total depth: Meganos - Martines

Commenced producing Non Productive (Date) Flowing/gas lift/pumping (Cross out unnecessary words) Name of producing zone

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casing Pressure
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Cementing if through perforations
8 5/8"	523	Surface	24#	New	Smlss	K-55	12 1/4	281 equiv.	

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was the well directionally drilled? Electrical Log Depths 4995' - 523' (Attach Copy of Log)

△ OSP

FORM 103 SUBMIT IN DUPLICATE △ OSP

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

History of Oil or Gas Well

OPERATOR GREAT BASINS PETROLEUM CO. FIELD ---

Well No. Rio Blanco - 1, Sec. 27, T. 3 N., R. 5 E., M. D. B. & M.

Date November 13, 19 72 Signed Charles W. Hatten
Charles W. Hatten

1011 Gateway West, Century City
Los Angeles, Calif. 90067 (213) 879-0666 Title President
(Address) (Telephone Number) (President, Secretary or Agent)

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting and initial production data.

1972

Date

10/14 Hunnicutt & Camp rig No. 1 spudded well @ 3:30 PM. Drilled 12 1/4" hole to 523' circulated; wiped hole; circulated clean; pulled out. Ran 13 Jts (525.37' O.A.) 8 5/8" 24#, K-55, new, smlss, 8 R. T. & C., Rg. 3, Armco casing equipped with Larkin guide shoe and one centralizer latched over first casing collar.

10/15 Halliburton cementers pumped 130 sx class "G" cement premixed w/ 4% gel & 2% $CaCl_2$ followed by 100 sx class "G" cement premixed w/ 2% $CaCl_2$ total slurry included 50% in excess of theoretical requirements @ 500'. C.I.P. 12:30 AM 10/15; had no cement returns to surface. Ran 1" tubing to 50' in annulus & pumped 50 sx class "G" cement with 2% $CaCl_2$ in mixing water; had four c.f. cement returns to surface. C.I.P. 1:30 AM 10/15. Stood cemented two hours. Landed casing; cut off conductor and casing. Installed National S.O.W. Series 900 casing head. Tested welds @ 2500 psig. Installed B.O.E. double hydraulic Shaffer rams and "GK" Hydril bag, both series 900; tested casing and C.S.O. rams @ 1500 psig Oke. Ran in with 7 7/8" bit. Located top of plug at 511'. Tested pipe rams, Hydril and Kelly cock at 1500 psig; held Oke. Drilled out plugs, cement and shoe at 3 PM. Drilled to 1932'. Mud weight 72 - 74 pcf, viscosity 41 - 45 secs/quart, water loss 10.8 cc. Drift surveys: 523' 0°30'.

10/16 Drilled 7 7/8" hole to 3085'; made bit trip. Stratagraphic Mud Logging Co. commenced sampling drilling returns at 3000'. Drilled to 4288'. Mud wt. 74 - 76 pcf, vis. 40 - 45, W.L. 10.6 - 8.6. Surveys: 2332' 1°15', 3085' 2°30'.

10/17 Drilled 7 7/8" hole to 5000'; circulated & conditioned mud; pulled out. Ran & recorded Schlumberger IES log. Ran bit #5 to drill ahead. Mud weight 76 - 78, vis. 42, W.L. 7.4. Surveys: 4°00' at 4828'.

10/18 Drilled 7 7/8" hole to 5450'. Circulated clean; pulled bit; layed down drill collars and portion of drill pipe. Ran in open ended to 557'. Halliburton equalized 100 sx class "G" cement premixed w/ 3% $CaCl_2$; C.I.P. 1:00 PM 10/18. Located top of firm cement at 360' at 5:00 PM; location and hardness of plug witnessed and approved by D.O.G. engineer. Layed down drill pipe. Cut off casing at cellar floor level (four feet below ground). Placed 25 feet cement plug in casing on top of mud sack bridge (29 feet below ground level). Welded steel plate over casing stub to complete abandonment. Rig released at 11:00 PM.

FORM 109

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

Report on Operations

No. T 672-220

Mr. Charles W. Hatten, Agent
GREAT BASINS PETROLEUM COMPANY
1011 Gateway West - Century City
Los Angeles, Cal. 90067

Woodland, Calif.
October 30, 1972

DEAR SIR:

Operations at well No. "Rio Blanco" 1(077-20172), Sec. 27, T. 3N., R. 5E., M.D. B & M. - - - Field, in San Joaquin County, were witnessed on October 18, 1972. Mr. R. Johnson, representative of the supervisor was present from 1645 to 1715. There were also present W. Camp, Drilling Foreman.

Present condition of well: 8-5/8" cem. 523'. TD 5450', plugged with cement 575'-360'.

The operations were performed for the purpose of witnessing the location and hardness of a cement plug placed in the process of abandonment.

Mr. reported:

THE LOCATION AND HARDNESS OF THE CEMENT PLUG AT 360' ARE APPROVED.

RJ;jp
cc: Company

Issuance of this report was delayed pending receipt of notice to abandon.

JOHN F. MATTHEWS, JR.
State Oil and Gas Supervisor

By R. M. Barger Deputy

59471-705 1-72 20M ® OSP

FORM 111

RESOURCES AGENCY OF CALIFORNIA

DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 672-295

Mr. Charles W. Hatten, Agent
GREAT BASINS PETROLEUM COMPANY
1011 Gateway West - Century City
Los Angeles, Cal. 90067

Woodland, Calif.
October 30, 1972

DEAR SIR:

(077-20172)

Your proposal to abandon Well No. "Rio Blanco" 1, Section 27, T. 3N., R. 5E., M.D. B. & M., - - - Field, San Joaquin County, dated 10-23-72, received 10-27-72, has been examined in conjunction with records filed in this office.

THE PROPOSAL COVERING WORK ALREADY COMPLETED UNDER PRIOR AGREEMENT IS APPROVED.

Blanket Bond
kMB:jp
cc: Company

JOHN F. MATTHEWS, JR., State Oil and Gas Supervisor

By R. M. Barges, Deputy

57628-708 11-71 8BM ⓓ OSP

FORM 108. 64284-705 2 66 10M ⓐ OSP

STATE OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

DIVISION OF OIL AND GAS
RECEIVED
OCT 27 1972
WOODLAND, CALIFORNIA

Notice of Intention to Abandon Well

This notice must be given at least five days before work is to begin; one copy only

Los Angeles Calif. October 23, 1972

DIVISION OF OIL AND GAS

In compliance with Division 3, Public Resources Code, notice is hereby given that it is our intention to abandon

Well No. Rio Blanco - 1, Sec. 27, T. 3 N., R. 5 E., M. D. B. & M., - - - Field, San Joaquin County,

commencing work on October 18, 1972.

THE PRESENT CONDITION OF THE WELL IS:

1. Total Depth: 5450'

2. Complete casing record, including plugs:
8 5/8" 24# K-55 Smlss casing cemented at 523' with 281 equivalent sx cement

3. Last Produced Non - productive
(Date) (Oil, B/D) (Gas, Mcf/D) (Water, B/D)

ADDITIONAL DATA FOR DRY HOLE

4. Oil or Gas showings and results of tests:
No showings
No tests

5. Stratigraphic markers and depths:

6. Formation at bottom: Meganes - Martinez

7. Base of fresh water sands: above 523'

THE PROPOSED WORK IS
in accordance with telephone conversation Stein - Johnson:

1) Place 100 feet cement plug 573' - 473'.

2) Place 25 feet cement plug 40' - 15'.

3) Cut off casing at cellar floor level; weld steel plate over casing stub.

MAP	MAP			FORMS 155	FORMS 121
	10/27/72 E	✓	✓	✓	✓

1011 Gateway West, Century City
Los Angeles, Ca. 90067
(Address)

(213) 879 - 0666
(Telephone No.)

GREAT BASINS PETROLEUM CO.
(Name of Operator)

By Charles Stallings President

ADDRESS ONE COPY OF NOTICE TO DIVISION OF OIL AND GAS IN DISTRICT WHERE WELL IS LOCATED

FORM 111

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS

REPORT ON PROPOSED OPERATIONS No. P 672-213

Floyd Tincher, Agent
GREAT BASINS PETROLEUM COMPANY
2694 Cottage Way #7
Sacramento, CA 95825

Woodland, Calif.
September 12, 1972

DEAR SIR:

Your ..... proposal to drill ..... Well No. "Rio Blanco" 1 (077-20172)
Section 27, T. 3N., R. 5E., M.D.B. & M., ... Field, San Joaquin County,
dated 9-5-72, received 9-8-72, has been examined in conjunction with records filed in this office.

THE PROPOSAL IS APPROVED PROVIDED THAT:

1. **The 8-5/8" casing is cemented with sufficient cement to fill behind this casing from the shoe to the ground surface.**
2. **Mud fluid of proper weight and consistency is used and the well is kept under control at all times.**
3. **Blowout-prevention equipment capable of shutting the well in during any operation is installed and maintained ready for use at all times.**
4. **Fresh waters, if present, are protected by cement behind the 4½" casing. Sufficient cement must be used to fill to at least 100' above the base of fresh waters.**
5. **This Division is notified:**
   a. **Before deviating from the proposed casing program and/or placing any plugs in the hole. Additional requirements shall be outlined at that time.**
   b. **To witness a pressure test of the blowout-prevention equipment prior to drilling out the shoe of the 8-5/8" casing.**
   c. **To witness a test of the 4½" water shut-off immediately above the objective zone.**

Blanket Bond
RJ:jp

cc:Co.

BOE waived 12-15-72
SC

JOHN F. MATTHEWS, JR., State Oil and Gas Supervisor

By R. M. Barger SC, Deputy

57628-708 11-71 85M ① OSP

Form 105

RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION

DIVISION OF OIL AND GAS
RECEIVED
SEP 8 1972
WOODLAND, CALIFORNIA

077-20172

DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and surety bond must be filed before drilling begins

Los Angeles Calif. September 5 1972

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division III, Article 4, Public Resources Code, notice is hereby given that it is our intention to commence drilling well No. Rio Blanco No. 1, Sec. 27, T. 3 N, R. 5 E, M.D. B. & M., King Island Field, San Joaquin County.

Legal description of mineral-right lease, consisting of 678 acres, is as follows: (Attach map or plat to scale)

Do mineral and surface leases coincide? Yes Yes No If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of Well: 2700 feet South (Direction) along ~~property~~ section line and 2000 feet West (Direction) at right angles to said line from the Northeast corner of ~~property~~ section 27

T 3 N R 5 E M.D. B. & M.

Elevation of ground above sea level 0 feet U.S.G.S. datum.

All depth measurements taken from top of Kelly Bushing (Derrick Floor, Rotary Table or Kelly Bushing) which is 11 feet above ground.

PROPOSED CASING PROGRAM

SIZE OF CASING INCHES A.P.I.	WEIGHT	GRADE AND TYPE	TOP	BOTTOM	CEMENTING DEPTHS
8-5/8"	24#	K-55	0	500'	500'
4-1/2"	9.5#	K-55	0	4900'	4900'

Intended zone(s) of completion: Mokelumne (Name) 4660' - 4900' (Depth, top and bottom) Estimated total depth 4900'

MAP	MAP BOOK	CARDS	BOND	FORMS 114	FORMS 121
		✓	B/B		✓

F W above 500'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address 1011 Gateway West - Century City
Los Angeles, California 90067

Great Basins Petroleum Co. (Name of Operator)

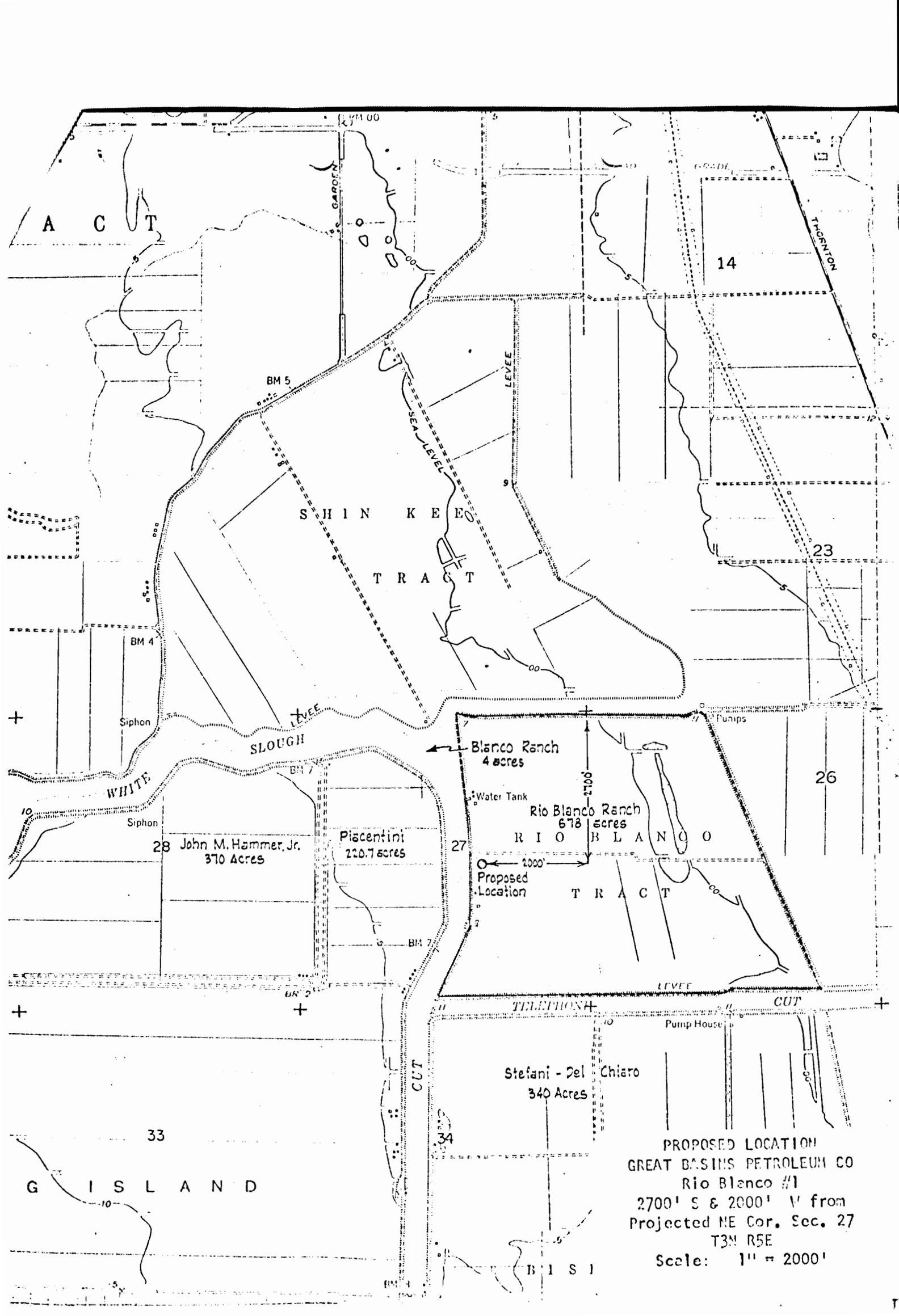
By C. W. Hatten, President

Telephone Number (213) 879-0666

Type of Organization Corporation (Corporation, Partnership, Individual, etc.)

(077-20172)

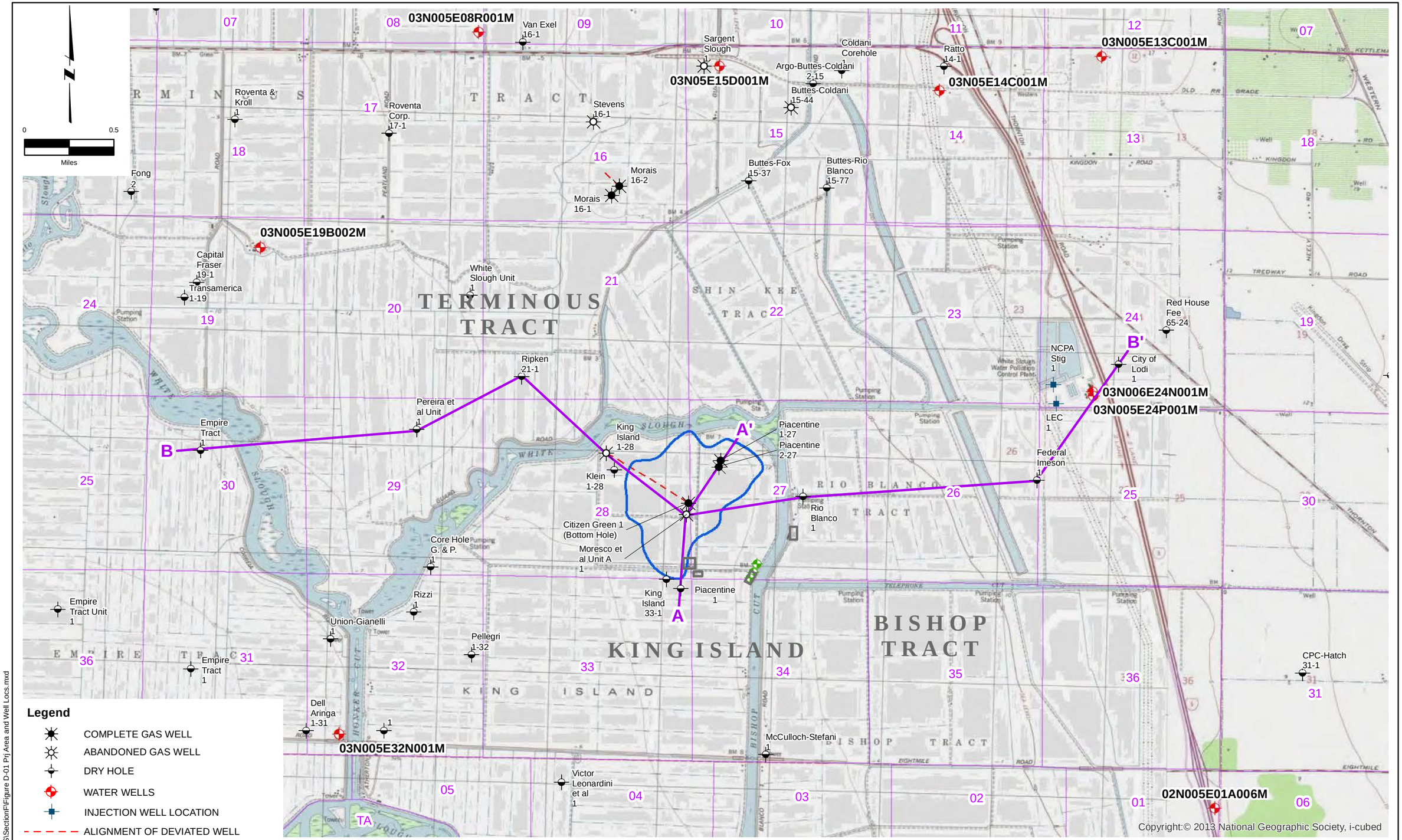
DSP



PROPOSED LOCATION
GREAT BASINS PETROLEUM CO
Rio Blanco #1
2700' S & 2000' W from
Projected NE Cor. Sec. 27
T3N R5E
Scale: 1" = 2000'

ATTACHMENT D

Maps and Cross Sections of USDW



Legend

- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- WATER WELLS
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- DOMESTIC WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- FARM IRRIGATION/DRAINAGE CANAL
- SECTION LINES

NOTE

FIGURE PREPARED BY:
JACOBSON, JAMES
& ASSOCIATES, INC.

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

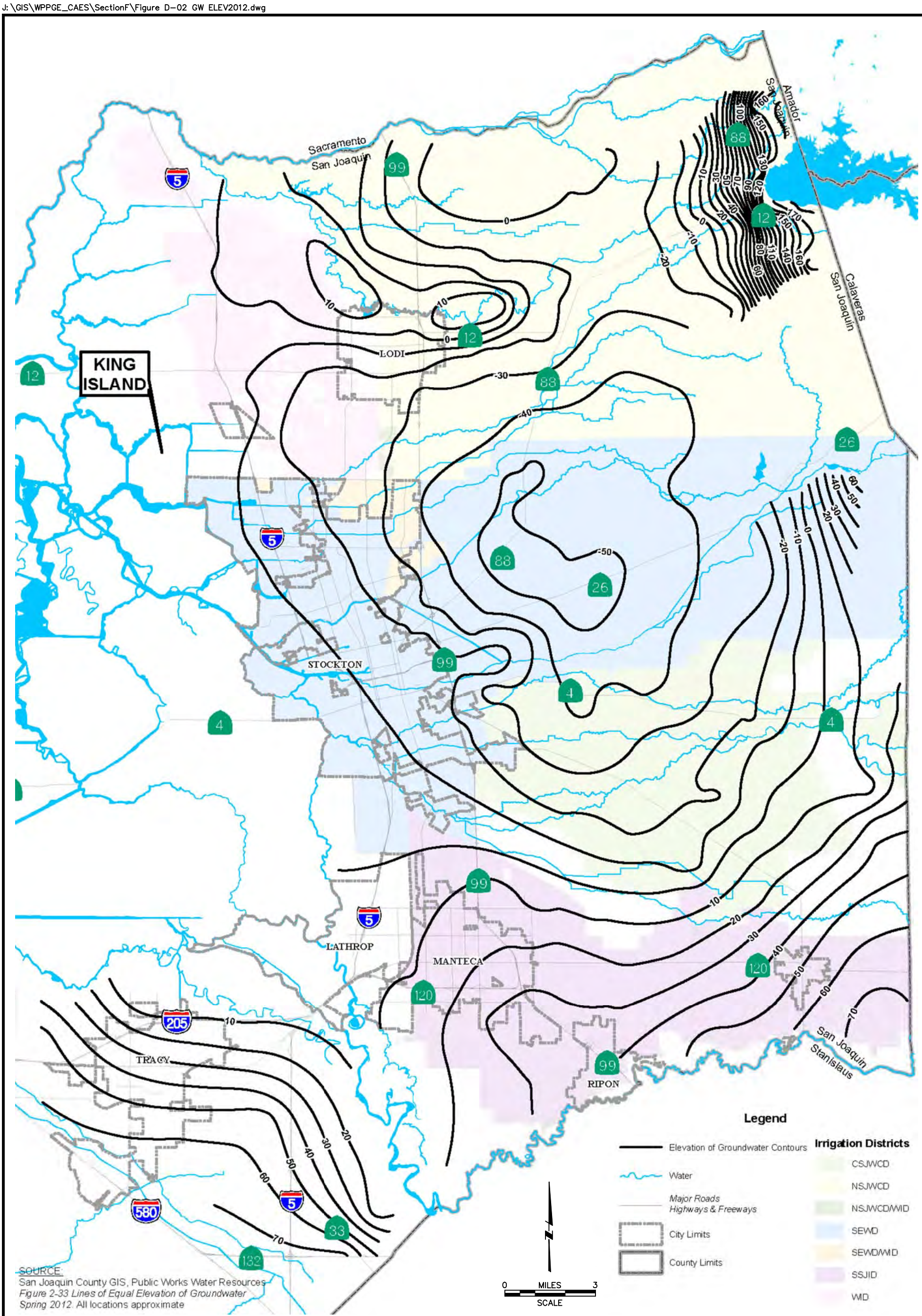
PROJECT No.	DATE	DRAWN BY	APPR. BY
03.WP.004	12/30/13	PEM	RF

FIGURE D-1

PROJECT AREA AND WELL LOCATIONS

Path: J:\GIS\WP\PGE_CAES\Section\Figure D-01 Prj Area and Well Locs.mxd

J:\GIS\WPPGE_CAES\SectionF\Figure D-02 GW ELEV2012.dwg



SOURCE:
San Joaquin County GIS, Public Works Water Resources
Figure 2-33 Lines of Equal Elevation of Groundwater Spring 2012. All locations approximate

NOTES:
ORIGNAL FIGURE BY: WORLEYPARSONS GROUP, 04-29-2013
FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

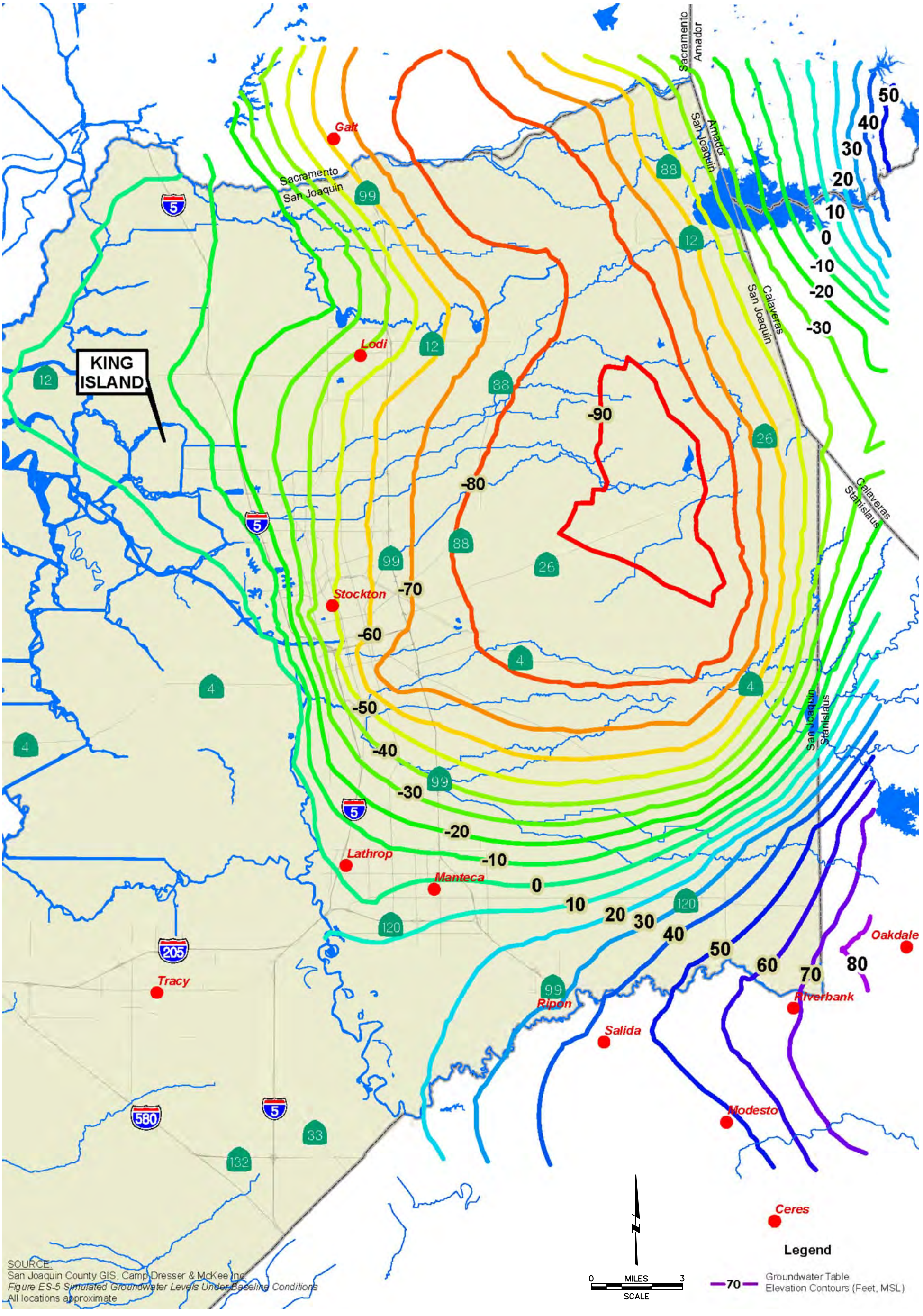
Prepared for
Pacific Gas and Electric Company

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPROVED BY
03.WP.004	12/17/13	PEM	RF

FIGURE D-2
SAN JOAQUIN COUNTY GROUNDWATER ELEVATION CONTOUR MAP SPRING 2012

J:\GIS\WPPGE_CAES\SectionF\Figure D-03 GW ELEVRegional.dwg



NOTES:

ORIGNAL FIGURE BY: WORLEYPARSONS GROUP, 04-29-2013

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

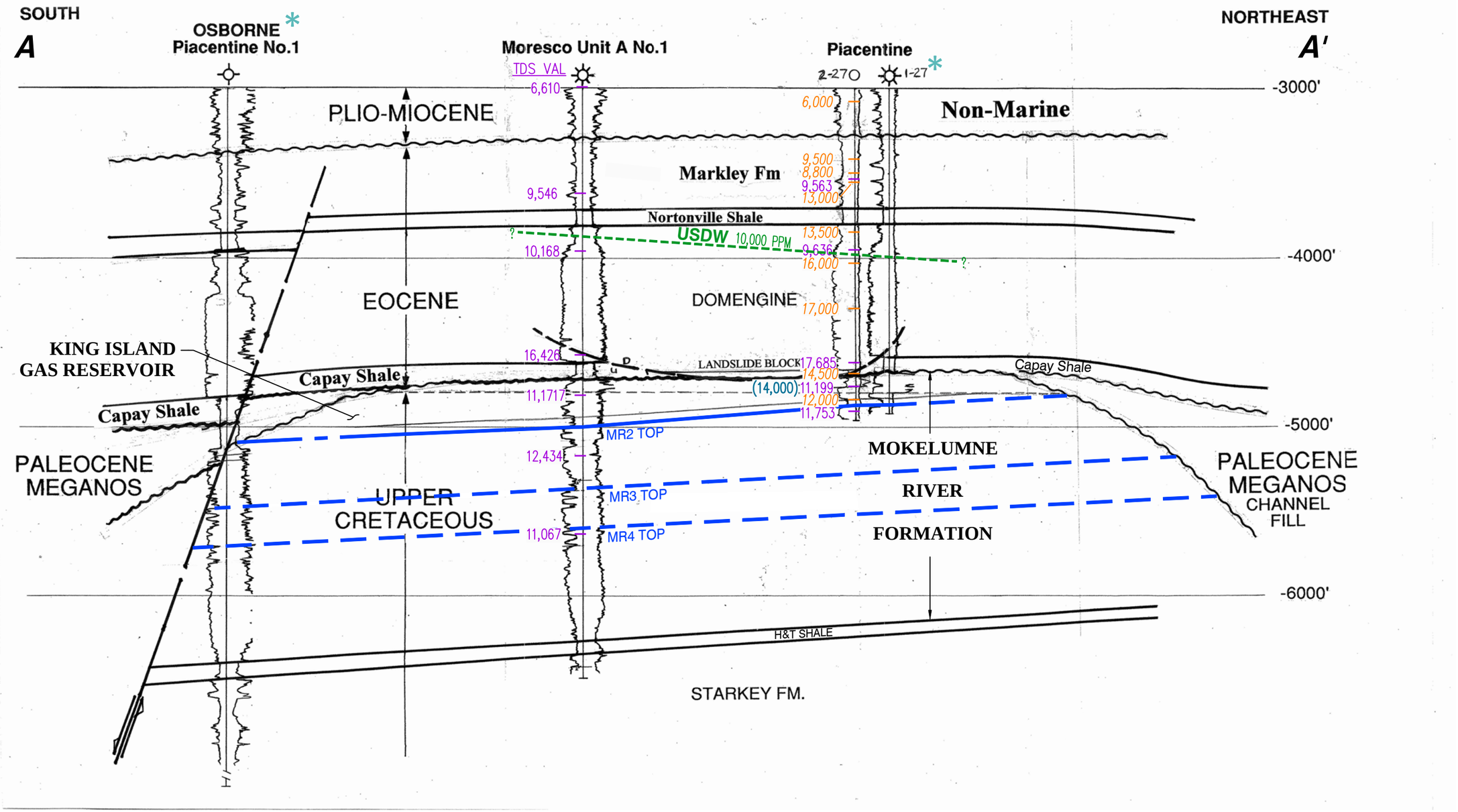
Prepared for
Pacific Gas and Electric Company

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPROVED BY
03.WP.004	12/17/13	PEM	RF

FIGURE D-3

SAN JOAQUIN COUNTY SIMULATED GROUNDWATER ELEVATION CONTOURS FROM REGIONAL MODEL



LEGEND

12,500	CALCULATED TDS VALUE USING SP METHOD
9,500	CALCULATED TDS VALUE USING ARCHIE METHOD
- - - - - -	10,000 PPM TDS CONTOUR
(14000)	LABORATORY MEASURED TDS CONCENTRATION
*	NOT USED TO CREATE TDS CONTOUR LINE

NOTE:

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP
TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

ABBREVIATIONS:

TDS	TOTAL DISSOLVED SOLIDS
PPM	PARTS PER MILLION

Prepared for
Pacific Gas and Electric Company

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPROVED BY
03.WP.004	12/30/13	PEM	RF

FIGURE D-4

SECTION A-A' AND BASE OF USDW

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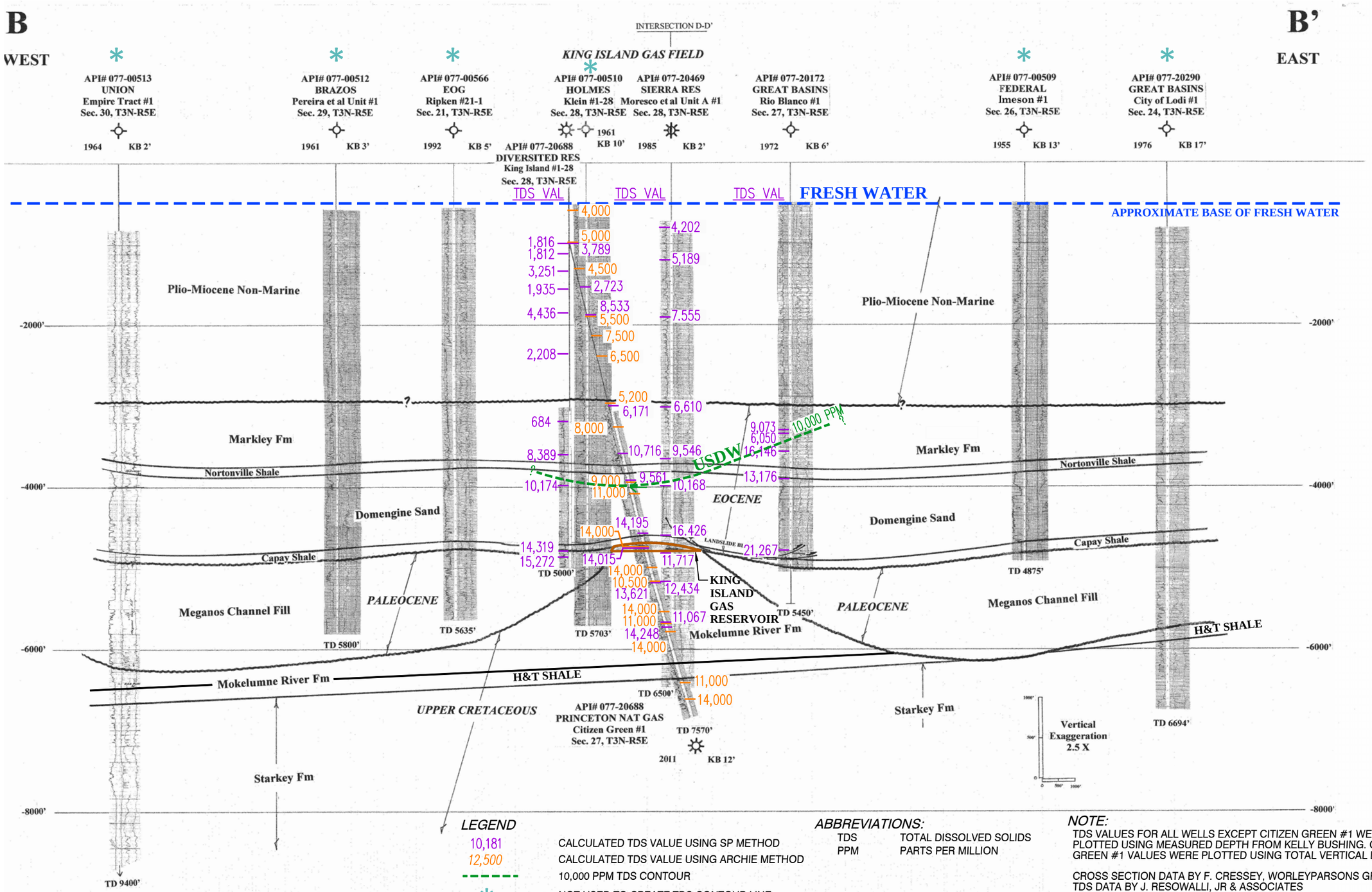


LEGEND

10,181	CALCULATED TDS VALUE USING SP METHOD
12,500	CALCULATED TDS VALUE USING ARCHIE METHOD
- - - - -	10,000 PPM TDS CONTOUR
*	NOT USED TO CREATE TDS CONTOUR LINE

ABBREVIATIONS:

TDS	TOTAL DISSOLVED SOLIDS
PPM	PARTS PER MILLION

NOTE:

TDS VALUES FOR ALL WELLS EXCEPT CITIZEN GREEN #1 WERE PLOTTED USING MEASURED DEPTH FROM KELLY BUSHING. CITIZEN GREEN #1 VALUES WERE PLOTTED USING TOTAL VERTICAL DEPTH.

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP
TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
Pacific Gas and Electric Company

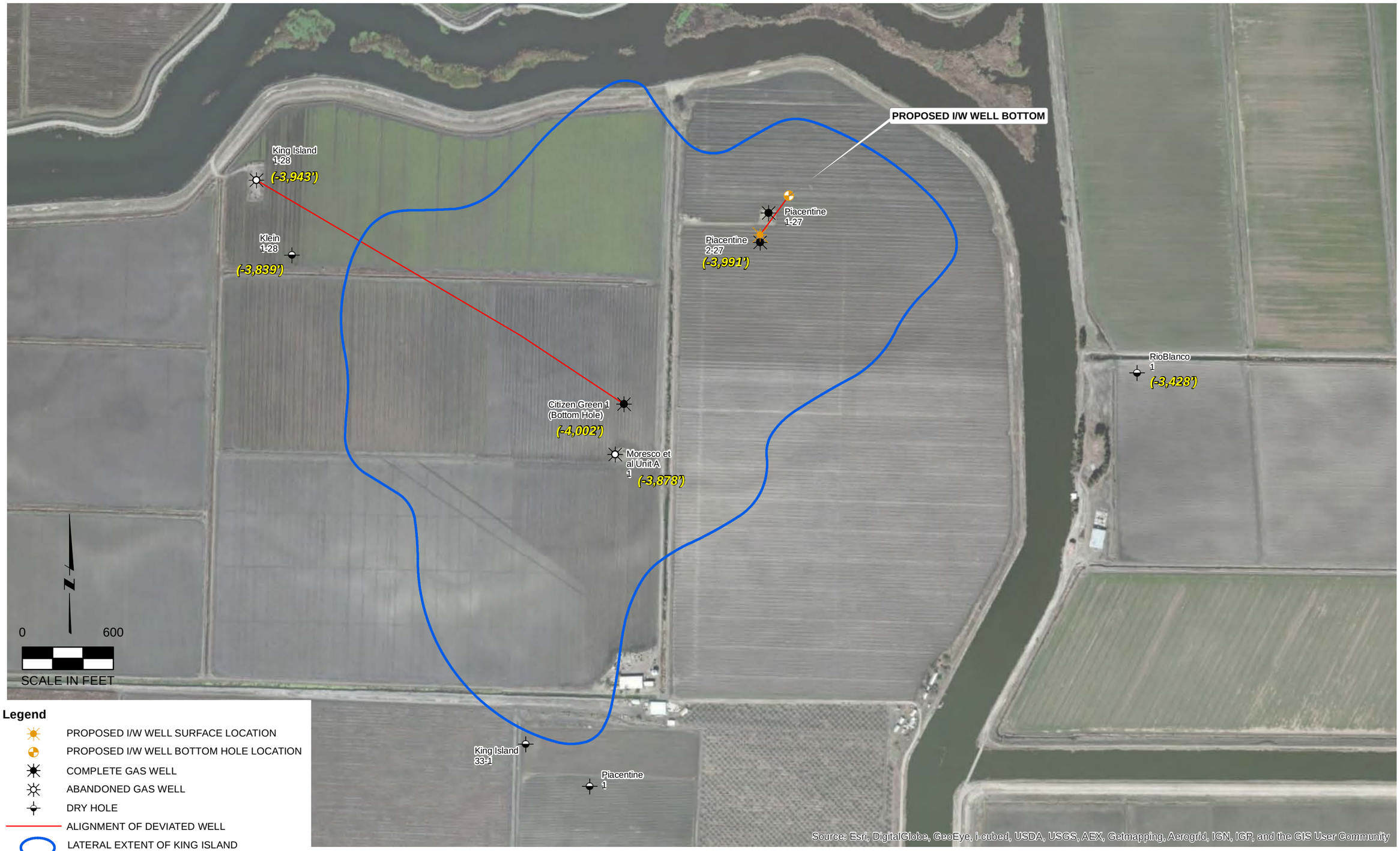
PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPROVED BY
03.WP.004	12/30/13	PEM	RF

FIGURE D-5

SECTION B-B' AND BASE OF USDW

J:\GIS\WPPGE_CAES\SectionF\Figure D-05 Section B-B.dwg



Legend

- PROPOSED I/W WELL SURFACE LOCATION
- PROPOSED I/W WELL BOTTOM HOLE LOCATION
- COMPLETE GAS WELL
- ABANDONED GAS WELL
- DRY HOLE
- ALIGNMENT OF DEVIATED WELL
- LATERAL EXTENT OF KING ISLAND GAS FIELD RESERVOIR SAND
- (3510') DEPTH TO BASE OF USDW (CALCULATED OR INTERPOLATED, SEE ATTACHMENT E)

Notes

ALL ELEVATIONS ARE SUBSEA

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Path: J:\GIS\WPPGE_CAES\SectionF\Figure D-06 isocore-Locations.mxd

Prepared for
PACIFIC GAS AND ELECTRIC COMPANY

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT No.	DATE	DRAWN BY	APPR. BY
03.WP.004	01/03/14	PEM	RF

FIGURE D-6

KING ISLAND RESERVOIR DEPTH TO USDW, AND WELL LOCATIONS

ATTACHMENT E

Name and Depths of USDWs

CONTENTS

Section E.1 Hydrogeology and Depth of Freshwater Aquifers

Section E.2 Geology and Depth of Underground Sources of Drinking Water

Section E.3 References

Table E-1 Ages and Thickness of Freshwater Deposits in Northern San Joaquin County

Table E-2 Water Well Completion Details and TDS Concentrations

Table E-3 TDS Concentrations Using SP Method

Table E-4 Formulas for SP Method of TDS Estimation

Table E-5 TDS Concentrations Using Archie Method

Graph E-1 TDS vs. Depth – Piacentine 1-27

Graph E-2 TDS vs. Depth – Piacentine 2-27

Graph E-3 TDS vs. Depth – Citizen Green 1

Graph E-4 TDS vs. Depth – Moresco A-1

Graph E-5 SP Method TDS Comparison

Attachment E-1 Pickett Plots

E.1 HYDROGEOLOGY AND DEPTH OF FRESHWATER AQUIFERS

California State Water Resources Control Board (SWRCB) Resolution 88-63 assigns groundwater resources containing up to 3,000 milligrams per liter (mg/L) of total dissolved solids (TDS) a potential beneficial use as drinking water. Similarly, the California Department of the Interior, Division of Oil Gas and Geothermal Resources (DOGGR) classifies freshwater as containing less than 3,000 mg/L TDS. These Freshwater Aquifers are a subset of Underground Sources of Drinking Water (USDW, defined in the UIC regulations as containing TDS below 10,000 mg/L). Nevertheless, freshwater aquifers warrant separate discussion because water supply wells in the area are completed in these deposits and they are regulated more stringently by the state.

The King Island gas field comprises approximately 3-acres of irrigated walnut tree orchard located just inside the eastern boundary of the Sacramento-San Joaquin Delta. The proposed test site is bounded by surface water bodies to the north (White Slough approximately 1,000 feet north) and to the east (Bishop Cut approximately 1,500 feet east). The area surrounding the test site is generally level and ranges in elevation from approximately 5 to 10 feet below sea level. Water levels in White Slough and Bishop Cut are slightly above sea level and are separated from King Island by a series of levees. The walnut tree orchard is irrigated by water from White Slough and Bishop Cut using a drip irrigation system, and groundwater levels beneath the orchard are maintained a depth of approximately 6 to 8 feet below ground level by a system of drains. Three shallow domestic water wells are located at a cluster of ranch residences approximately 3,000 feet southeast of the site (Figure D-1). Construction information is not available for these wells; however, most of the domestic and agricultural wells in the region are believed to be between 100 and 200 feet deep based on data from the National Water Information System (NWIS; USGS, 2013) and the reported depth of fresh water at the King Island gas field.

The King Island gas field is located in the northwestern portion of the Eastern San Joaquin groundwater sub-basin (ESJSB), which occupies the central portion of the Northern San Joaquin hydrogeologic basin (NSJHB). The NSJHB lies within the Central Valley hydrogeologic province (DWR, 2006). Marine clastic sediments (sands, silts and clays) were deposited in the Central Valley from middle Cretaceous through middle Tertiary time. These high salinity water bearing marine sedimentary deposits are unconformably overlain by lower salinity to fresh water bearing continental sediments that were deposited from Miocene through Recent time.

The approximately upper 3,000 feet of sediments beneath King Island are Miocene and younger continental deposits that occur in the Mehrten Formation and overlying alluvial, lacustrine and Flood Basin Deposits. The alluvial, lacustrine and Flood Basin Deposits represent basinward finer-grained facies stratigraphically equivalent to the Laguna, Riverbank, and Modesto Formations, and overlying Recent sediments. The lithologies and approximate age and thickness of these are provided in Table E-1, below (DWR, 2006).

TABLE E-1 – AGES AND THICKNESS OF FRESHWATER DEPOSITS IN NORTHERN SAN JOAQUIN COUNTY

Formation	Age	Thickness (feet)	Lithologies	Hydrogeological Characteristics
Flood Plain Deposits	Pliocene to Recent	1,400+	Unconsolidated fine-grained sand, silt and clay.	Generally lower permeability. Unconfined to confined aquifers.
Mehrten Formation	Late Miocene to Pliocene	1,300+	Moderately to well indurated andesitic ("black") sandstone interbedded with conglomerate, tuffaceous siltstone and claystone.	Moderate to high permeability in "black sands" units. Wells typically yield 1,000 gallons per minute. Confined to semi-confined aquifers.

There is no detailed information on shallow aquifers in the site area, including depth, lithology, water levels and water quality, including for the three shallow domestic wells mentioned above. The information presented below was derived from available public sources of information.

In northern San Joaquin County, groundwater is not extensively used in the area west of Interstate Highway 5 (San Joaquin County Department of Public Works, 2004). Nine water wells are reported in the NWIS as being located between 2 and 3 miles from the site and are reported to be between 33 and 142 feet in depth (USGS, 2013). The locations of these wells are shown on Figure D-1 and available well completion and analytical data are summarized in Table E-2. TDS analyses results were available for seven of the wells, with concentrations ranging from 63 to 3,140 milligrams per liter (mg/L), though the second highest concentration was only 1,640 mg/L. No analytical data were available for the other two wells.

All of the gas exploration and production wells in and near the field have surface casing set to a minimum depth of 496 feet (in the Klein #1-28, Table C-1), and the interval behind the surface casings has not been logged. DOGGR well histories for wells in and near the field are included as Attachment C-1. The well histories report that base of fresh water (BFW) for most of these wells occurs at 400 feet. The exceptions are the Klein #1-28 and the Rio Blanco #1, for which BFW is reported to occur above 500 feet, and the Piacentine 1-27 and the Piacentine 2-27, for which BFW is reported to occur at 150 feet. The DOGGR Field Rules for the King Island Gas Field report an assumed depth to the base of fresh water of less than 500 feet (DOGGR, 2007). The above data support a depth of fresh water, as defined by the State of California, of less than 500 feet, and possibly as shallow as 150 feet. Based on regional hydrogeologic studies, fresh water would occur in fine-grained unconsolidated sands in the "Flood Plain Deposits" hydrostratigraphic unit described by DWR (2006).

Overdraft pumping in the ESJSB has created groundwater depressions in the central portion of the sub-basin, including east of Stockton and east of Lodi, where groundwater pumping is concentrated. This has caused poorer quality groundwater from the Sacramento-San Joaquin Delta to flow towards the east

(San Joaquin County Department of Public Works, 2004). Shallow extensions of these depressions extend westward approximately to Interstate Highway 5. Accordingly, groundwater beneath King Island is expected to flow towards the east (Figures D-2 and D-3). Groundwater withdrawals for irrigation also create a strong component of downward flow in the areas east of Stockton and Lodi.

E.2 GEOLOGY AND DEPTH OF UNDERGROUND SOURCES OF DRINKING WATER

USDW are defined in the Underground Injection Control (UIC) regulations as being groundwater resources with TDS concentrations less than 10,000 mg/L (40 CFR 144.3). As such, they include water that is more saline than California-defined fresh water resources and they typically underlie these fresh water resources to a greater depth. The base of the Mehrten Formation represents a major unconformity separating late Miocene continental deposits from a thick sequence of Eocene to Upper Cretaceous marine deposits (Figures D-4 and D-5). By virtue of their provenance, groundwater in these marine deposits typically is more saline than in the overlying fresh water deposits.

An evaluation of the lateral and vertical extent of USDW within and near the King Island Gas Field and the East Islands Gas Field was conducted by collecting and evaluating a formation water sample from the King Island gas reservoir during drilling of the Piacentine 2-27 core well in March and April 2013 and reviewing electrical logs from nine gas exploration and production wells located in and near the gas field. The purpose of the evaluation was to determine at what depths formation water meets the UIC criteria for USDW (< 10,000 mg/L of TDS). The well information reviewed included spontaneous potential (SP) and resistivity logs from study area wells. Well histories, including electric logs, of these King Island Gas Field wells are included as Attachment C-1.

TDS can be determined through laboratory analysis of water samples collected from formations of interest. This method is the most accurate and is the preferred method of the USEPA when data are available. A report prepared on the behalf of the USEPA states: *"Sampling and chemical analyses is the benchmark method to determine TDS concentrations"; and "TDS concentration developed from chemical analyses is the preferred method of determining formation water quality"* (Ken E. Davis Associates, 1988). An *in-situ* depth-discrete water sample was collected in the Mokelumne River Formation (MRF) target injection zone (at 4,774 feet MD) in the Piacentine 2-27 core well using Halliburton's Reservoir Description Tool (RDT™). The sample was analyzed in a laboratory for a comprehensive suite of cations and anions, as well as TDS by the gravimetric method. Detailed analytical results for this sample are reported in Attachment H-2. The laboratory-derived TDS is more accurate than a TDS value based on electric log interpretation, and is considered representative for the MRF target injection zone. The MRF formation water sample had a TDS concentration of 14,000 mg/L, which is significantly above the UIC criteria for USDW of 10,000 mg/L of TDS.

There are no known water sample laboratory analytical results available for TDS in the formations overlying the MRF from any of the King Island or nearby wells. For these shallower formations, it is necessary to rely on electric log analysis for the estimation of TDS in formation water. TDS estimates

obtained through electric log analysis are typically within $^{+}$/- 15% of laboratory derived TDS values (Ken E. Davis Associates, 1988).

TDS was calculated using two electric log analysis methods; the SP method and the Archie method. The SP method involves calculation of pore water resistivity (R_w) using SP log readings in sand zones, followed by determination of TDS using Schlumberger Chart Gen-6 (Schlumberger, 2009). The chart relates R_w (in Ohm-m^2/m) to salinity (TDS) as sodium chloride (NaCl) in parts per million over a range of temperatures. The Archie method calculates R_w using resistivity and porosity log readings in sand zones and Archie's Equation, followed by TDS determination using Schlumberger Chart Gen-6.

SP METHOD

The R_w in a water-saturated sand zone can be calculated using the amplitude of the SP curve (E, in millivolts), the formation temperature (FT in degrees Celsius or Fahrenheit) and the resistivity of the mud filtrate (R_{mf}, in ohm-m^2/m) at the formation temperature.

Well log SP curve measurements (representing static SP measurements, or SSP) were made from the shale baseline in thick water saturated sands. The well log header provided the remaining inputs required for the calculations, including bottom hole temperature (BHT), R_{mf} and the temperature of the R_{mf} measurement. R_{mf} is measured at the well site with a handheld instrument, at least once before the well is logged.

An Excel spreadsheet was developed to perform the series of calculations required to derive estimates of TDS in formation water at the depths for which SSP measurements were taken (Table E-3). The spreadsheet includes the formulas or calculation methodology and a list of abbreviations, as shown below:

TABLE E-4 – FORMULAS FOR SP METHOD OF TDS ESTIMATION

Table E-3 Column	Formulas
Column F:	FT (deg C) = (((BHT - MST) / well total depth)) * FD) + MST
Column G:	FT (deg F) = (deg C * 9/5) + 32
Column H:	R_{mf} at FT = R_{mf} at measurement T * [(measurement T + 6.77) / FT + 6.77)] *(Source: Schlumberger chart Gen-6)*
Column I:	R_{weq} = 0.85 * R_{mf} * 10^(SSP / (60.5 + 0.133 * FT)); incorporating the following equations:
	R_{mfeq} = 0.85 * R_{mf}@FT (when R_{mf}@75 > 0.1) *(Source: Schlumberger chart SP-1)*

Table E-3 Column	Formulas
	SSP = -Kc * log(R_{mfeq} / R_{weq}) *(Source: Schlumberger chart SP-1)*
	K_c = 60.5 * 0.133 * FT *(Source: Ransom, Robert C., 1995)*
Column J:	Empirical solution to Schlumberger chart SP-2, providing R_W from R_{weq} at FT.
Column K:	R_w at 400 deg F = R_w at FT * [FT + 6.77) / 400 + 6.77)] *(Source: Schlumberger chart Gen-6)*
Column L:	Empirical solution to Schlumberger chart Gen-6, providing TDS in ppm from R_w at 400 deg F.

BHT = Bottom hole temperature
deg C = Degrees Celsius
deg F = Degrees Fahrenheit
FD = Formation depth of interest
FT = Formation temperature at depth of interest
K_c = Electrochemical sponteneous potential coefficient
MD = Measured depth from drill rig kelly bushing
MST = Mean surface temperature
Ohm-m^2/m = Ohm-meters squared per meter
ppm = parts per million
R_{mf} = Resistivity of mud filtrate (Ohm-m^2/m)
R_{mfeq} = Equivalent mud filtrate resistivity (Ohm-m^2/m)
R_{mc} = Resistivity of mud cake (Ohm-m^2/m)
R_W = formation water resistivity
R_{weq} = Equivalent water resistivity
SSP = Static spontaneous Potential (millivolts)
T = Temperature
TDS = total dissolved solids in ppm

The general methodology for the SP method is summarized below:

- SSP measurement is read from SP log curve (Table E-3, Column E)
- Temperature at the depth of each sand is interpolated, based on a temperature gradient for each well derived from the average mean surface temperature of 60.8 °F (16 °C) and the BHT (Table E-3, Column F)

- Using the measured R_{mf} value (Table E-3, Column C) and the temperature from the log header (Table E-3, Column B), an R_{mf} at formation temperature is calculated using the formula presented in Schlumberger chart Gen-6 (Table E-1, Column H).
- Using a formula that combines equations provided with Schlumberger chart SP-1, a corresponding R_{weq} is calculated (Table E-3, Column I).
- Using an empirical solution to Schlumberger chart SP-2, R_{weq} is converted to R_w at the formation temperature (Table E-3, Column J).
- Convert R_w at formation temperature to R_w at 400 deg F using the formula presented in Schlumberger chart Gen-6 (Table E-3, Column K).
- Using an empirical solution to Schlumberger chart Gen-6, determine TDS in ppm at 400 deg F (Table E-3, Column L).

ARCHIE METHOD

R_w can also be derived using the Archie Equation (Archie, G.E., 1942) in the following form:

$$R_w = \phi^m * R_t / a$$

Where:

ϕ = porosity

m = cementation factor

R_t = formation resistivity

a = tortuosity factor

Archie's method depends on reliable porosity data, which are available for only two wells in the King Island area, the Piacentine 2-27 and the Citizen Green 1, both of which were logged using neutron and density tools. The well logs with porosity curves derived from the neutron and density curves are provided in Attachment C-1. For this reason, the Archie method was only performed for these two wells.

The cementation factor (m) and R_w were derived using a Pickett Plot (Pickett, G.R., 1966), which is the logarithm of the Archie equation expressed as a logarithmic plot of formation resistivity (R_t) versus porosity (ϕ). Points of constant water saturation (S_w) plot on a straight line with negative slope of value "m". A Pickett plot was developed for each sand package of interest and used to derive a value of R_w, assuming constant values of 1.7 for m and 1.0 for "a". The Pickett Plots are provided in Attachment E-1.

Schlumberger chart Gen-6 was then used to determine the formation water salinity (TDS) for each sand package based on the Pickett Plot derived R_w value and the temperature of the formation at that depth

(based on the temperature gradient established for the SP method). The R_w and TDS values thus derived are annotated on the Pickett Plot sheets in Attachment E-1 and presented in Table E-5.

Discussion and Comparison of SP and Archie Method Calculation Results

Graphs presenting TDS versus depth were prepared for the four wells inside the Area of Review (AOR): Piacentine 1-27, Piacentine 2-27, Citizen Green 1 and Moresco A-1 (Graphs E-1, E-2, E-3 and E-4, respectively). The graphs show the stratigraphic intervals in which the deepest USDWs (sand packages with <10,000 ppm TDS) occur.

At the two wells for which both Archie and SP method TDS values were derived (Piacentine 2-27 and Citizen Green 1), there is reasonably good agreement in the TDS values, especially for the Citizen Green 1 (Graphs E-2 and E-3). One or both of the methods in all four graphs demonstrate that the TDS values >10,000 ppm first occur in the upper portion of the Domengine Formation (Figures D-4 and D-5). Three of the four graphs show TDS concentrations >10,000 ppm in the Mokelumne Formation (Graphs E-2, E-3 and E-4). Only the Piacentine 1-27 has a TDS value <10,000 ppm in the Mokelumne River Formation; specifically, a calculated value of 8,778 ppm at a depth of 4,800 feet within the lower lobe of the King Island gas field reservoir, just below the original gas/water contact. This TDS value is not considered accurate or representative of Mokelumne River Formation salinity, based on the following evidence:

1. Nearly all the TDS values in the Piacentine 1-27 are significantly lower than in the other three wells in the AOR (Graph E-5). The Piacentine 1-27 should have similar TDS values, as all four wells penetrated and logged the same formations and are located near one another in the same unfaulted reservoir. Proximity is especially noteworthy in the case of the Piacentine 1-27 and Piacentine 2-27, which are located only about 200 feet from one another (Figure F-13). This suggests the Piacentine 1-27 results may be biased low.

2. The SP method derived TDS values for the Piacentine 2-27 and the Citizen Green 1 are comparable to the Archie method derived TDS values (Graphs E-2 and E-3), with both methods showing the base of USDW just above or below the Nortonville Shale and TDS values consistently >10,000 ppm in the Mokelumne River Formation. This correlation provides further support for the reliability of the SP method derived TDS values in the Piacentine 2-27 and the Citizen Green 1, and casts further doubt on the SP-derived TDS values for the Piacentine 1-27.

3. As discussed above, the water sample collected from a depth of 4,774 feet in the Mokelumne River Formation reservoir in the Piacentine #2-27 was analyzed in the laboratory and found to have a TDS concentration of 14,000 ppm. This concentration is nearly identical to the Archie method derived TDS value of 14,500 ppm, and comparable to the SP method derived TDS value of 11,199, taken from the same reservoir sand sampled in the Piacentine 2-27 (Tables E-3 and E-4). On the other hand, it is doubtful that the SP method derived TDS value of 8,778 ppm in the Piacentine 1-27, from the same depth and reservoir sand sampled in the Piacentine 2-27, is

correct, as the difference is too great for wells located only approximately 200 feet from one another with no apparent intervening geologic discontinuities (i.e. fault).

Based on the evidence presented above, it is concluded that the SP method derived TDS values in the Piacentine 1-27 are not correct, and therefore, have not been used in the determination of USDW in the AOR and have not been plotted on the geologic cross-sections referenced in the discussion below. There are two other wells in the vicinity but outside the reservoir and AOR with SP method derived TDS values that are also believed to be incorrect (too high): the King Island 33-1 and the Piacentine 1 (Table E-3; Figure D-6). A faulty R_{mf} measurement is considered the most likely reason for the too low TDS in the Piacentine 1-27 and the too high TDS in the King Island 33-1 and the Piacentine 1. R_{mf} readings may be incorrect for a variety of reasons, including crew error while taking or recording the reading, instrument error or mis-calibration, or mud properties that changed during drilling and/or as logging tools were run in and out of the borehole[1]. In the case of the Piacentine 1-27, the R_{mf} is probably too high and in the case of the King Island 33-1 and the Piacentine 1, the R_{mf} is probably too low.

USDW Occurrence and Protection

The approximate depth of the base of USDW at each well was determined by interpolation (Table E-3). The TDS concentrations from Tables E-3 and E-5 (with the exception of the incorrect TDS values for the three wells discussed above) were plotted on geological cross-sections (Figures D-4 and D-5), and the approximate depth of the base of USDW, represented by the TDS 10,000 ppm concentration contour, is depicted. The depth to the base of USDW in the area surrounding the proposed Injection/Withdrawal (IW) Well is also shown on Figure D-6. For the purpose of defining the base of USDW, in the two wells with TDS values derived from both the SP and Archie methods (Piacentine 2-27 and Citizen Green 1), the higher TDS values were used. As can be seen in the cross sections, within and in the vicinity of the AOR and the King Island gas field, the base of USDW generally occurs just below the Nortonville Shale in the Domengine Formation between approximately 3,800 and 4,000 feet in depth. The only exception is the Rio Blanco 1, in which the USDW occurs above the Nortonville Shale in the Markley Formation at an approximate depth of 3,400 feet. Based on the above, the base of USDW is separated from the target injection zone by approximately 700 feet of sedimentary section, which includes most of the Domengine Formation and the Capay Shale.

Correlation of well logs in the region demonstrates that the Capay Shale is regionally extensive (Attachment F: Figures F-5, F-6 and F-7). Several lines of evidence demonstrate that the Capay Shale, which directly overlies the injection zone, is a competent lower permeability unit with proven sealing capability (refer to Attachment G, Section G.5 for a detailed discussion):

- The Capay Shale forms the caprock for several gas fields in the area, including the King Island and East Islands Field. The Capay Shale held these gas accumulations intact for several million years;

[1] See http://water.epa.gov/learn/training/dwatraining/upload/dwaUIC-uicpermit.pdf

- Pressure data collected in the King Island Piacentine 2-27 demonstrate that the Mokelumne River Formation reservoir sands below the Capay shale are in a different pressure regime than the Domengine Formation sands overlying the Capay shale (Table G-5); and
- The Capay Shale comprises low permeability sediments, with a harmonic mean vertical permeability of about 0.05 mD (Table G-6).

The Capay Shale ranges in thickness from 90 to 120 feet in the vicinity of King Island, though it is only 35 feet thick in the northeastern portion of the King Island gas field due to faulting at the head of a paleo-landslide that soles out in the Capay and does not cut the underlying Mokelumne River Formation reservoir (refer to discussion in Attachment G, Section G.3 and Figures F-6 and F-10). This feature cuts out 60 feet of Capay Shale in the Piacentine 2-27 and a similar amount of section in the overlying lower part of the Domengine Sand in the Piacentine 1-27. The competency of the Capay Shale, even at the thin area at the head of the paleo-landslide, is demonstrated by the evidence discussed above and presented in Attachment G, Section G.5.

Though the Capay Shale on its own is considered an excellent seal for the Mokelumne River Formation reservoir, the Nortonville Shale, which is approximately 100 feet thick in the vicinity of King Island provides a competent shallower secondary seal, representing an additional layer of protection to USDWs in the overlying Markley Formation. The Nortonville Shale can be identified on all well logs in the region based on a SP and gamma ray signature characteristic of a marine shale unit, as demonstrated on Figures F-5, F-6 and F-7. The Nortonville Shale thins towards the north and thickens to more than 200 feet approximately 1-mile to the south, but is laterally continuous for at least a 2-mile radius around King Island (Figures F-6 and F-7). The Nortonville Shale is interpreted to be cut by the fault located just south of the King Island Gas (Figure D-4; see discussion in Attachment G, Section G.3), but otherwise appears to be uncomplicated by significant structural deformation in the project area. The Nortonville Shale will act to prevent movement of fluid from USDWs in the top of the Domengine to USDWs in the Markley Formation.

The above data compares favorably to an analysis of USDW made for an injection well recently installed approximately 2 ½ miles east of the site at the Northern California Power Authority (NCPA) Lodi Power Plant, where it was found that the Domengine Formation contained TDS at concentrations exceeding USDW levels.

E.3 REFERENCES

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TABLE E-2
WATER WELL COMPLETION DETAILS AND TDS CONCENTRATIONS
PG&E Compressed Air Energy Storage Project
King Island, San Joaquin County, California

State Well Number	Latitude	Longitude	North American Datum	Depth of Well (feet below land surface)	National Aquifer	Local Aquifer	Land Surface Elevation (feet above NGVD29)	TDS Concentration (PPM)
03N005E32N001M	38° 03' 36"	-121° 27' 35"	NAD27	42	Central Valley	Flood-Basin Deposits	--	465
03N005E24P001M	38° 05' 17"	-121° 22' 58"	NAD27	142	Central Valley	Flood-Basin Deposits	7	656
03N005E08R001M	38° 07' 01"	-121° 26' 50"	NAD83	33	Central Valley	Flood-Basin Deposits	7	1640
03N006E24N001M	38° 05' 18"	-121° 23' 02"	NAD83	--	Central Valley	--	8	708 E
03N005E19B002M	38° 05' 58"	-121° 28' 06"	NAD27	59	Central Valley	Flood-Basin Deposits	--	63
03N05E15D001M	38°06'52"	-121°25'21"	NAD83	--	--	--	--	--
03N05E14C001M	38°06'45"	-121°25'60"	NAD83	--	--	--	--	--
02N005E01A006M	38°03'16.6"	-121°22'15.5"	NAD83	68	Central Valley	--	4	3140
03N005E13C001M	38°06'56"	-121°22'56"	NAD27	114	Central Valley	Alluvial Fan Deposits	13	427

Notes:

E = estimated

NGVD29 = National Geodetic Vertical Datum of 1929

PPM = parts per million

TDS = total dissolved solids

° = degrees

' = minutes

" = seconds

-- = not available

TABLE E-3
TDS CONCENTRATIONS USING SP METHOD
PG&E Compressed Air Energy Storage Project
King Island, San Joaquin County, California

Well	Data from Log Header Used in TDS Calculations		Depth (MD or VD in feet) [1]	Spontaneous Potential (millivolts)	Formation Temperature (deg C)	Formation Temperature (deg F)	Resistivity of Mud Filtrate (Ohms-m^2/m)	Equivalent Resistivity of Formation Water (Ohm-m^2/m)	Resistivity of Formation Water (Ohm-m^2/m)	Resistivity of Formation Water at 400F (Ohm-m^2/m)	Calculated TDS 0f Formation Water (ppm)	Interpolated Depth to USDW (feet)	Comments
A	B	C	D	E	F	G	H	I	J	K	L		M
King Is. 1-28	Rm (Ohm-m^2/m) at 94°F	4.31	1,000	-35.3	23.0	73.4	4.37	1.17	2.93	0.577	1,816		
	Rmf (Ohm-m^2/m) at 93°F	3.51	1,120	-35.3	23.9	75.0	4.28	1.15	2.88	0.578	1,812		
	Rm (Ohm-m^2/m) at BHT	3.33	1,345	-44.1	25.4	77.8	4.14	0.84	1.57	0.326	3,251		
	Rmf at BHT	2.68	1,560	-36.4	27.0	80.5	4.01	1.05	2.53	0.542	1,935		
	BHT (°F)	124	1,850	-49.6	29.0	84.2	3.85	0.67	1.08	0.241	4,436		
	BHT (°C)	51.1	2,340	-38.8	32.4	90.4	3.60	0.89	1.99	0.476	2,208		
	Total Depth (ft)	5000	3,180	-22.7	38.3	101.0	3.25	1.36	5.73	1.517	684		
			3,600	-63.8	41.3	106.3	3.10	0.37	0.47	0.132	8,389	3,943	
			3,980	-68.5	43.9	111.1	2.97	0.31	0.38	0.110	10,174		
			4,790	-77.8	49.6	121.3	2.73	0.22	0.26	0.080	14,319		
			4,860	-79.5	50.1	122.2	2.71	0.21	0.24	0.076	15,272		
Citizen-Green 1	Rm (Ohm-m^2/m) at 73.1°F	3.24	1000	-30.0	23.5	74.3	2.53	0.81	1.41	0.281	3,789		
	Rmf (Ohm-m^2/m) at 73.1°F	2.57	1550	-25.0	27.6	81.7	2.32	0.88	1.78	0.388	2,723		
	Rm (Ohm-m^2/m) at BHT	1.61	1900	-45.0	30.3	86.5	2.20	0.44	0.56	0.129	8,533		
	Rmf at BHT	1.28	3010	-40.0	38.6	101.5	1.90	0.46	0.66	0.176	6,171		
	BHT (°F)	154	3610	-52.0	43.1	109.6	1.76	0.30	0.37	0.105	10,716		
	BHT (°C)	67.8	3940	-50.0	45.6	114.0	1.70	0.32	0.39	0.116	9,561	4,002	
	Total Depth (ft)	6900	4595	-60.0	50.5	122.9	1.58	0.22	0.25	0.081	14,195		
			4780	-60.0	51.9	125.4	1.55	0.22	0.25	0.082	14,015		
			5200	-60.0	55.0	131.0	1.49	0.22	0.25	0.084	13,621		
			5750	-62.0	59.1	138.5	1.41	0.20	0.23	0.081	14,248		
Piacentine 1-27	Rm (Ohm-m^2/m) at 92°F	3.96	960	-36.9	22.4	72.4	5.07	1.28	3.56	0.693	1,508		
	Rmf (Ohm-m^2/m) at 66°F	5.52	1,370	-47.4	25.2	77.4	4.78	0.87	1.67	0.345	3,070		
	Rm (Ohm-m^2/m) at BHT	3.10	1,870	-51.8	28.6	83.4	4.46	0.72	1.22	0.271	3,935		
	Rmf at BHT	3.17	2,400	-46.6	32.1	89.8	4.16	0.80	1.61	0.381	2,770		The TDS calculations from these data are too low probably because of a faulty Rmf reading (too high).
	BHT (°F)	120	3,200	-46.2	37.5	99.5	3.78	0.76	1.56	0.408	2,584		
	BHT (°C)	48.9	3,445	-63.9	39.1	102.4	3.68	0.43	0.59	0.158	6,922		
	Total Depth (ft)	4900	3,540	-58.9	39.8	103.6	3.64	0.50	0.75	0.204	5,284		
			3,970	-65.9	42.6	108.8	3.48	0.39	0.52	0.149	7,356		
			4,080	-74.7	43.4	110.1	3.44	0.30	0.35	0.102	11,079		
			4,800	-70.9	48.2	118.8	3.20	0.32	0.41	0.126	8,778		
Piacentine 2-27	Rm (Ohm-m^2/m) at 72°F	3.4	735	-26.2	21.1	70.0	2.67	0.96	1.88	0.355	2,977		
	Rmf (Ohm-m^2/m) at 69°F	2.71	970	-26.7	22.7	72.9	2.58	0.91	1.76	0.345	3,070		
	Rm (Ohm-m^2/m) at BHT	2.06	1,600	-29.8	27.1	80.8	2.34	0.76	1.34	0.288	3,693		
	Rmf at BHT	1.78	1,870	-42.3	29.0	84.2	2.26	0.49	0.66	0.147	7,478		
	BHT (°F)	123	2,355	-37.0	32.4	90.3	2.12	0.56	0.83	0.197	5,476		Rmf @ BHT calculated using Schlumberger Gen 3
	BHT (°C)	50.6	3,540	-49.1	40.6	105.1	1.84	0.34	0.42	0.116	9,563		
	Total Depth (ft)	4970	3,960	-49.8	43.5	110.4	1.75	0.32	0.40	0.116	9,636	3,991	
			4,640	-64.9	48.3	118.9	1.63	0.20	0.22	0.067	17,685		
			4,770	-54.2	49.2	120.5	1.61	0.27	0.32	0.101	11,199		
			4,910	-55.5	50.1	122.2	1.59	0.26	0.30	0.096	11,753		
Klein 1-28	Rm (Ohm-m^2/m) at 88°F	2.9	1,000	-51.0	23.3	73.9	2.75	0.44	0.52	0.103	10,895		
	Rmf (Ohm-m^2/m) at 88°F	2.34	1,920	-57.1	30.0	86.0	2.39	0.33	0.37	0.083	13,726		
	Rm (Ohm-m^2/m) at BHT	2.0	2,150	-53.9	31.7	89.0	2.32	0.35	0.41	0.097	11,611		
	Rmf at BHT	1.75	2,900	-40.6	37.1	98.8	2.10	0.50	0.74	0.191	5,644		Rmf at 88°F calculated using Schlumberger Gen 3
	BHT (°F)	129	3,610	-60.7	42.3	108.1	1.93	0.25	0.29	0.081	14,206		
	BHT (°C)	53.9	3,700	-46.5	43.0	109.3	1.91	0.39	0.52	0.150	7,315	3,839	
	Total Depth (ft)	5200	4,070	-61.9	45.7	114.2	1.83	0.24	0.27	0.080	14,461		
			4,660	-73.3	50.0	121.9	1.72	0.16	0.18	0.055	21,783		
Rio Blanco 1	Rm (Ohm-m^2/m) at 90°F	1.85	3,300	-36.3	39.2	102.5	1.32	0.36	0.45	0.122	9,073		
	Rmf (Ohm-m^2/m) at 75°F	1.76	3,340	-28.3	39.5	103.0	1.31	0.46	0.66	0.179	6,050	3,428	
	Rm (Ohm-m^2/m) at BHT	1.34	3,565	-49.4	41.0	105.9	1.28	0.24	0.26	0.072	16,146		Rmf @ BHT calculated using Schlumberger Gen 3
	Rmf at BHT	1.08	3,900	-45.1	43.4	110.1	1.23	0.26	0.30	0.087	13,176		
	BHT (°F)	124	4,800	-58.2	49.7	121.5	1.12	0.17	0.18	0.057	21,267		
	BHT (°C)	51.1											
	Total Depth (ft)	5000											
Moresco A-1	Rm (Ohm-m^2/m) at 70°F	4.61	795	-45.0	21.5	70.7	4.12	0.80	1.33	0.254	4,202		
	Rmf (Ohm-m^2/m) at 63°F	4.58	1,200	-48.8	24.3	75.8	3.87	0.67	1.02	0.208	5,189		
	Rm (Ohm-m^2/m) at BHT	2.38	1,900	-56.3	29.2	84.5	3.50	0.49	0.65	0.145	7,555		
	Rmf at BHT	2.15	3,000	-55.2	36.8	98.3	3.04	0.46	0.64	0.165	6,610		
	BHT (°F)	142	3,630	-63.5	41.2	106.1	2.83	0.34	0.42	0.117	9,546	3,878	
	BHT (°C)	61.1	3,970	-65.4	43.6	110.4	2.73	0.31	0.38	0.110	10,168		
	Total Depth (ft)	6500	4,590	-77.6	47.9	118.1	2.56	0.21	0.23	0.071	16,426		
			4,820	-70.0	49.5	121.0	2.50	0.26	0.31	0.096	11,717		
			5,175	-72.0	51.9	125.4	2.42	0.24	0.28	0.091	12,434		
			5,640	-70.1	55.1	131.3	2.32	0.25	0.30	0.102	11,067		
King Island 33-1	Rm (Ohm-m^2/m) at 81°F	1.54	810	-27.2	21.5	70.7	1.57	0.54	0.70	0.133	8,261		
	Rmf (Ohm-m^2/m) at 82°F	1.37	1,220	-37.2	24.3	75.7	1.47	0.37	0.42	0.084	13,597		
	Rm (Ohm-m^2/m) at BHT	1.00	1,920	-40.6	29.0	84.3	1.33	0.31	0.34	0.075	15,377		
	Rmf at BHT	0.90	2,670	-32.6	34.1	93.4	1.21	0.37	0.45	0.110	10,192		The TDS calculations from these data are too high probably because of a faulty Rmf reading (too low).
	BHT (°F)	128	3,680	-43.0	41.0	105.8	1.08	0.24	0.27	0.075	15,551		
	BHT (°C)	53.3	3,920	-30.6	42.6	108.7	1.05	0.35	0.44	0.126	8,793		
	Total Depth (ft)	5500	4,150	-55.4	44.2	111.5	1.03	0.16	0.17	0.050	24,770		
			4,910	-58.4	49.3	120.8	0.95	0.14	0.15	0.047	26,436		
			5,460	-57.5	53.1	127.5	0.90	0.14	0.15	0.049	24,839		
Piacentine 1	Rm (Ohm-m^2/m) at 96°F	1.40	1,210	-46.7	24.6	76.2	0.92	0.17	0.17	0.035	37,458		Rmf at 96°F calculated using Schlumberger Gen 3
	Rmf (Ohm-m^2/m) at 96°F	0.74	1,830	-45.8	28.9	84.1	0.84	0.16	0.17	0.037	34,642		
	Rm (Ohm-m^2/m) at BHT	0.73	2,580	-36.8	34.2	93.6	0.76	0.20	0.21	0.052	23,459		
	Rmf at BHT	0.52	3,700	-48.2	42.2	107.9	0.66	0.13	0.14	0.038	33,580		
	BHT (°F)	183	3,780	-51.7	42.7	108.9	0.66	0.11	0.12	0.035	37,612		The TDS calculations from these data are too high probably because of a faulty Rmf reading (too low).
	BHT (°C)	83.9	4,220	-63.7	45.8	114.5	0.63	0.08	0.09	0.027	53,158		
	Total Depth (ft)	9600	5,100	-57.9	52.1	125.7	0.57	0.09	0.10	0.032	42,629		
			6,530	-55.4	62.2	143.9	0.50	0.09	0.10	0.035	36,960		
			7,220	-61.1	67.1	152.7	0.48	0.07	0.08	0.032	42,633		

Average mean air temperature in °C (Sacramento, CA): 16
http://www.allcountries.org/uscensus/408_normal_daily_mean_temperature_selected_cities.htm

Notes
1 - MD for vertical wells and VD for directional wells (Citizen Green #1)

Abbreviations
BHT = Bottom hole temperature
deg C = Degrees Celsius
deg F = Degrees Fahrenheit
SSP = Static spontaneous Potential (millivolts)
FD = Formation depth of interest
FT = Formation temperature at depth of interest
K_c = Electrochemical sponteneous potential coefficient
MD = Measured depth in feet from drill rig kelly bushing
MST = Mean surface temperature
Ohm-m^2/m = Ohm-meters squared per meter
ppm = parts per million
R_m = Resistivity of mud (Ohm-m^2/m)
R_{mf} = Resistivity of mud filtrate (Ohm-m^2/m)
R_{mfeq} = Equivalent mud filtrate resistivity (Ohm-m^2/m)
R_{mc} = Resistivity of mud cake (Ohm-m^2/m)
R_W = formation water resistivity
R_{weq} = Equivalent water resistivity
T = Temperature
TDS = total dissolved solids
USDW = Underground sources of drinking water
VD = Vertical depth in feet from drill rig kelly bushing

Formulas *(Source)*
Column F: FT (deg C) = (((BHT - MST) / well total depth)) * FD) + MST
Column G: FT (deg F) = (deg C * 9/5) + 32
Column H: R_{mf} at FT = R_{mf} at measurement T * [(measurement T + 6.77) / FT + 6.77)] *(Source: Schlumberger chart Gen-6)*
Column I: R_{weq} = 0.85 * Rmf * 10^SSP / (60.5 + 0.133 * FT); incorporating the following equations:
R_{mfeq} = 0.85 * R_{mf}@FT (when R_{mf}@75 > 0.1) *(Source: Schlumberger chart SP-1)*
SSP = -K_c * log(R_{mfeq} / R_{weq}) *(Source: Schlumberger chart SP-1)*
K_c = 60.5 * 0.133 * FT *(Source: Ransom)*
Column J: Empirical solution to Schlumberger chart SP-2, providing R_W from R_{weq} at FT.
Column K: R_w at 400 deg F = R_w at FT * [FT + 6.77) / 400 + 6.77)] *(Source: Schlumberger chart Gen-6)*
Column L: Empirical solution to Schlumberger chart Gen-6, providing TDS from R_w at 400 deg F.

TABLE E-5
TDS CONCENTRATIONS USING ARCHIE METHOD
PG&E Compressed Air Energy Storage Project
King Island, San Joaquin County, California

Well	Depth Interval (MD in ft) [1]		Depth Interval (VD in ft) [1]		Resistivity of Formation Water (Ohm-m^2/m) [2]	TDS (ppm) [3]
	Top	Bottom	Top	Bottom		
A	D	E	F	G	I	J
Citizen Green 1	520	650	592	650	1.684	4,000
	992	1,020	989	1,017	1.11	5,000
	1,340	1,360	1,328	1,347	1.177	4,500
	1,680	1,700	1,643	1,660	1.586	3,300
	1,970	1,990	1,892	1,909	0.912	5,500
	2,050	2,090	1,960	1,995	0.912	5,500
	2,250	2,280	2,133	2,159	0.645	7,500
	2,540	2,570	2,382	2,407	0.707	6,500
	3,250	3,370	2,986	3,003	0.807	5,200
	3,550	3,585	3,243	3,273	0.527	8,000
	3,950	3,990	3,584	3,618	0.496	8,000
	4,350	4,500	3,928	4,061	0.467	9,000
	4,500	5,100	4,061	4,597	0.31	11,000
	5,130	5,150	4,623	4,640	0.308	11,000
	5,220	5,370	4,700	4,830	0.268	14,000
	5,430	5,490	4,883	4,936	0.298	11,500
	5,510	5,560	4,954	4,999	0.26	14,000
	5,630	5,650	5,062	5,080	0.27	13,000
	5,710	5,850	5,135	5,263	0.308	10,500
	5,910	5,935	5,318	5,342	0.25	14,000
	5,990	6,080	5,393	5,477	0.27	12,000
	6,100	6,200	5,496	5,590	0.242	14,000
	6,210	6,240	5,600	5,628	0.28	11,000
	6,260	6,280	5,647	5,666	0.28	11,000
	6,310	6,340	5,695	5,723	0.258	12,500
	6,360	6,400	5,742	5,780	0.262	14,000
	7,030	7,080	6,378	6,426	0.275	11,000
	7,130	7,140	6,473	6,483	0.22	14,000
	7,240	7,290	6,578	6,625	0.22	14,000
	7,330	7,370	6,663	6,701	0.25	13,000

TABLE E-5
TDS CONCENTRATIONS USING ARCHIE METHOD
PG&E Compressed Air Energy Storage Project
King Island, San Joaquin County, California

Well	Depth Interval (MD in ft) [1]		Depth Interval (VD in ft) [1]		Resistivity of Formation Water (Ohm-m^2/m) [2]	TDS (ppm) [3]
	Top	Bottom	Top	Bottom		
A	D	E	F	G	I	J
Piacentine 2-27	950	990			0.9	6,700
	1,170	1,190			0.986	6,000
	1,330	1,370			0.954	6,000
	1,410	1,430			1.041	5,500
	1,580	1,610			0.89	6,200
	1,830	1,850			0.728	7,000
	1,860	1,880			0.728	7,000
	1,920	1,940			0.82	6,500
	2,350	2,360			0.697	7,000
	2,910	2,925			0.597	7,000
	3,120	3,135			0.692	6,500
	3,190	3,200			0.744	6,000
	3,400	3,430			0.5	9,000
	3,450	3,495			0.423	9,500
	3,520	3,530			0.499	8,800
	3,565	3,585			0.337	13,000
	3,620	3,700			0.304	14,000
	3,890	4,040			0.306	13,500
	4,070	4,230			0.263	16,000
	4,350	4,450			0.27	15,000
	4,460	4,580			0.25	17,000
	4,585	4,645			0.278	13,500
	4,750	4,815			0.26	14,500
	4,860	4,890			0.308	12,000

Notes

(1) MD for vertical well (Piacentine 2-27) and VD for directional well (Citizen Green 1)

(2) Resistivity of formation water (R_w) derived using Pickett Plots (provided in Attachment E-1)

(3) TDS values derived using Schlumberger chart Gen-6

Abbreviations

BHT = Bottom hole temperature

MD = Measured depth in feet from drill rig kelly bushing

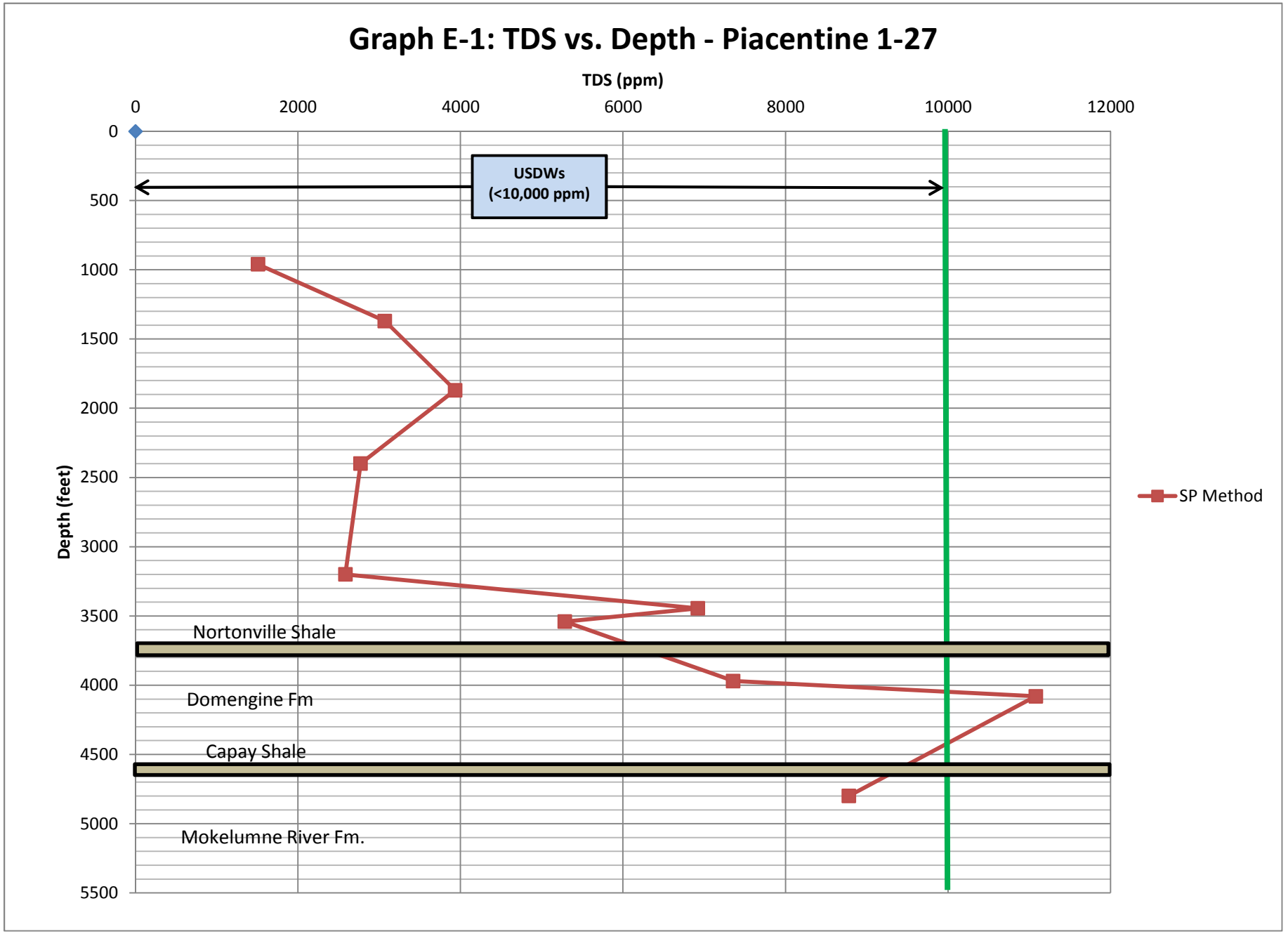
Ohm-m^2/m = Ohm-meters squared per meter

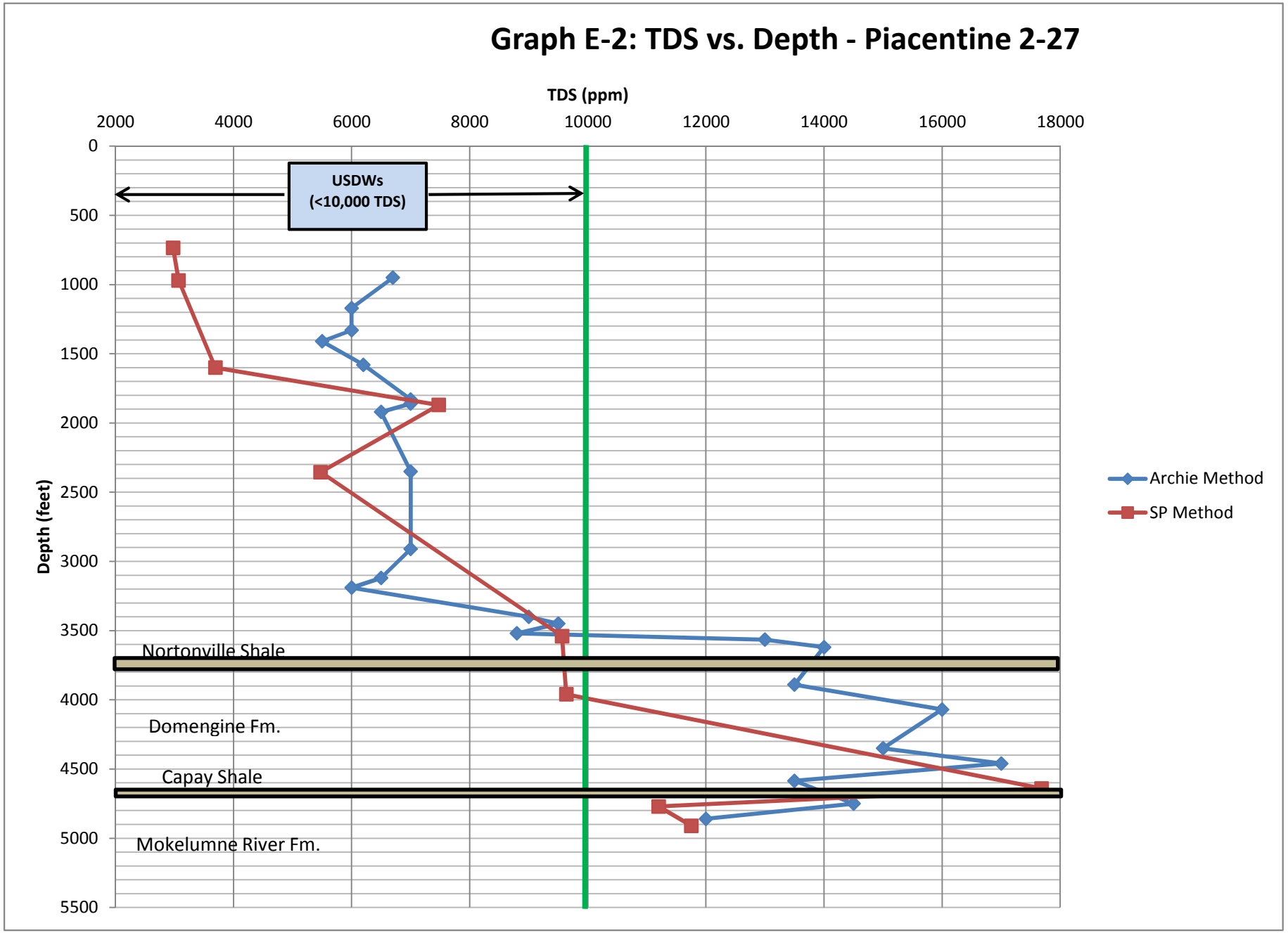
ppm = parts per million

R_W = formation water resistivity

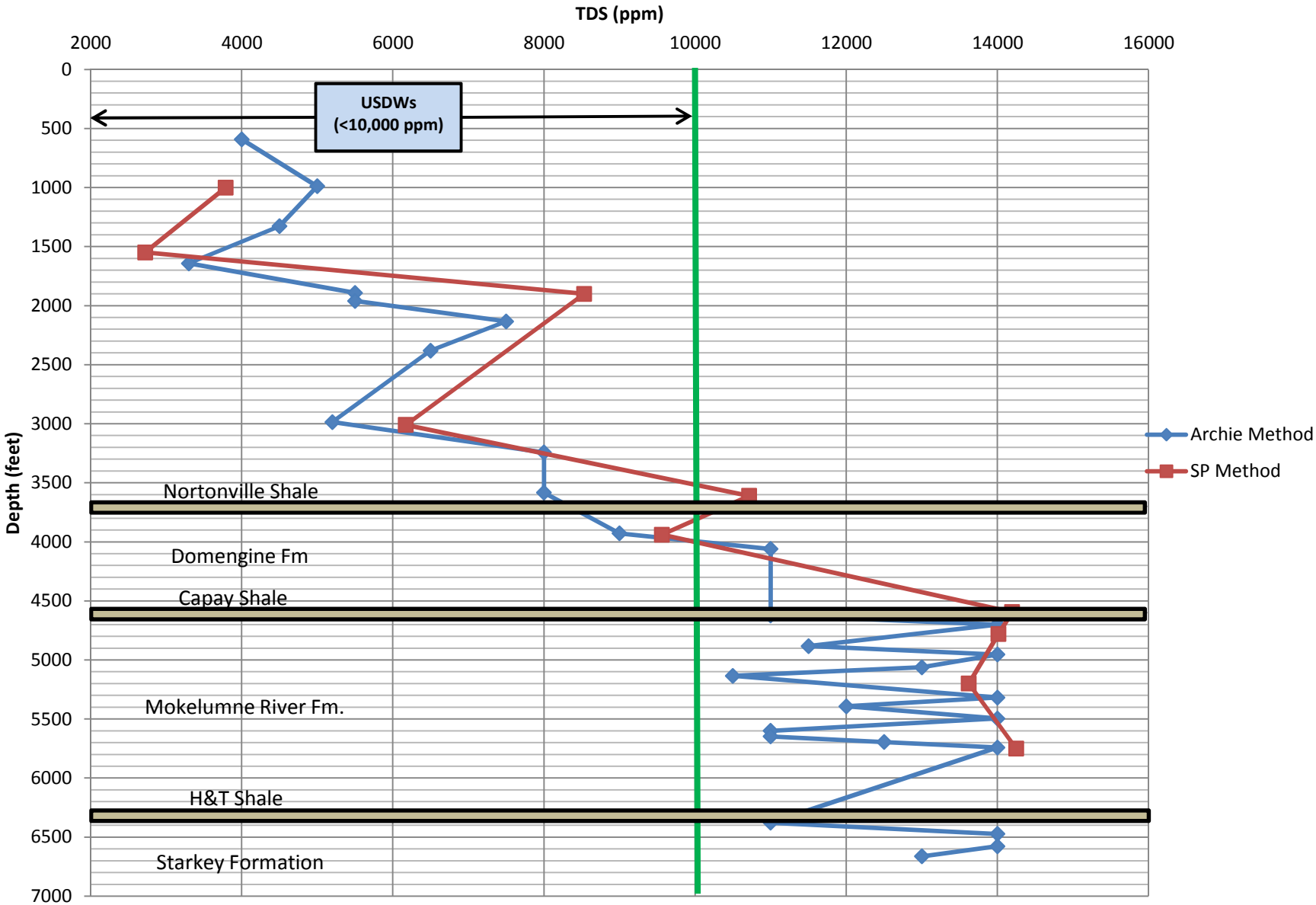
TDS = total dissolved solids

VD = Vertical depth in feet from drill rig kelly bushing

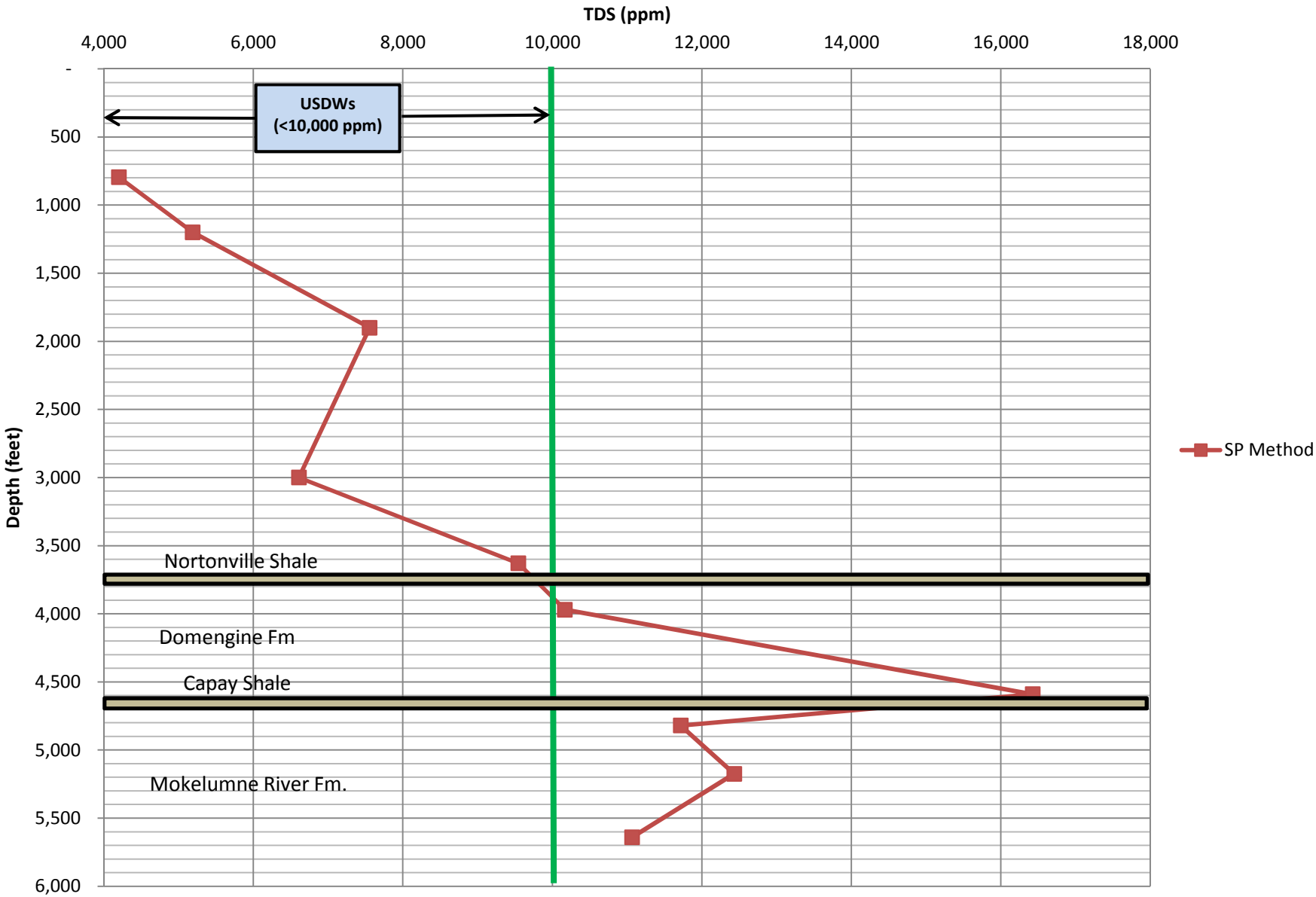

Graph E-1: TDS vs. Depth - Piacentine 1-27
TDS (ppm)
0
2000
4000
6000
8000
10000
12000
Depth (feet)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
USDWs
(<10,000 ppm)
Nortonville Shale
Domengine Fm
Capay Shale
Mokelumne River Fm.
SP Method

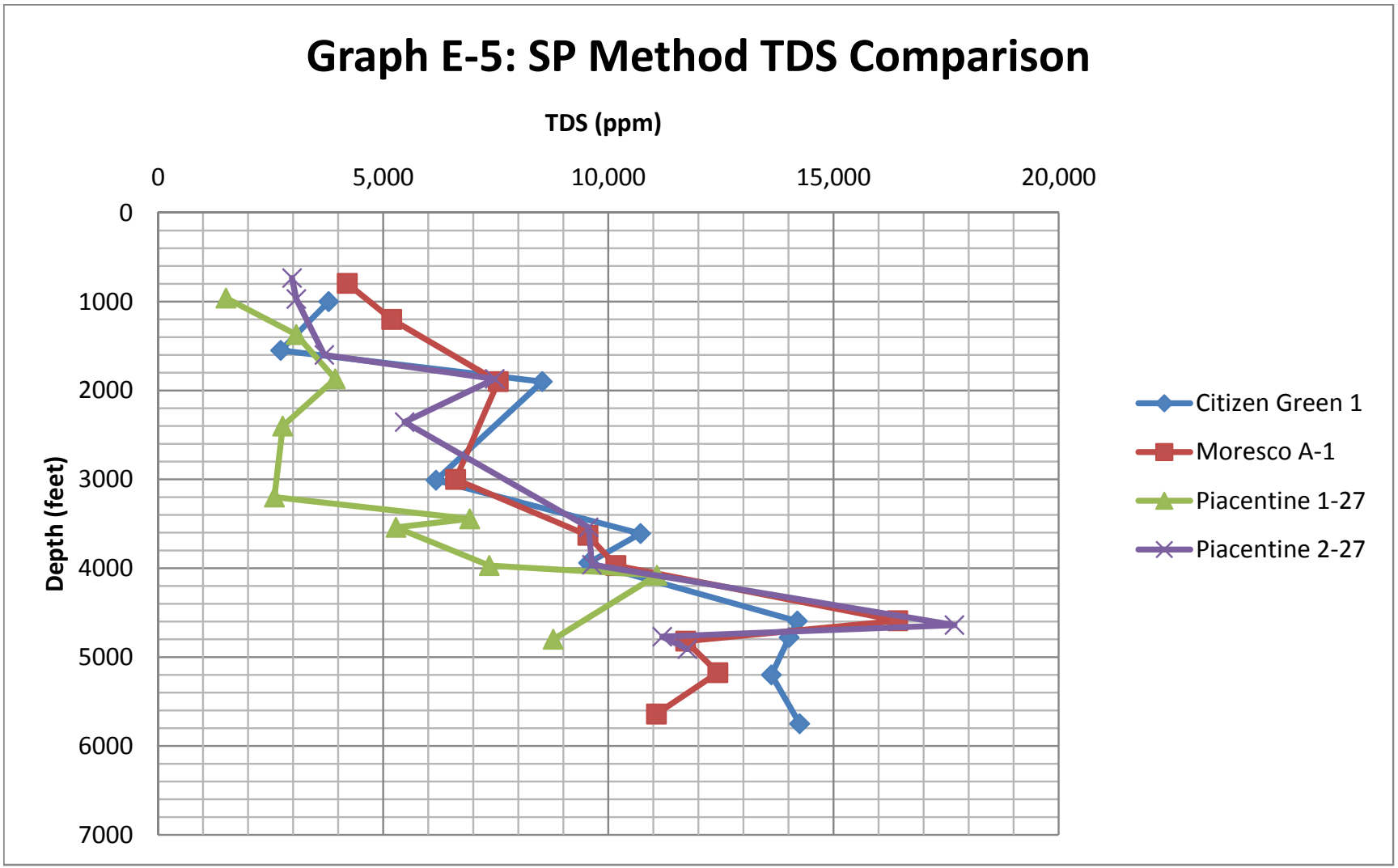

Graph E-2: TDS vs. Depth - Piacentine 2-27
TDS (ppm)
2000
4000
6000
8000
10000
12000
14000
16000
18000
Depth (feet)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
USDWs
(<10,000 TDS)
Nortonville Shale
Domengine Fm.
Capay Shale
Mokelumne River Fm.
Archie Method
SP Method

Graph E-3: TDS vs. Depth Citizen Green 1



Graph E-4: TDS vs. Depth - Moresco A-1




Graph E-5: SP Method TDS Comparison
TDS (ppm)
0
5,000
10,000
15,000
20,000
Depth (feet)
0
1000
2000
3000
4000
5000
6000
7000
Citizen Green 1
Moresco A-1
Piacentine 1-27
Piacentine 2-27

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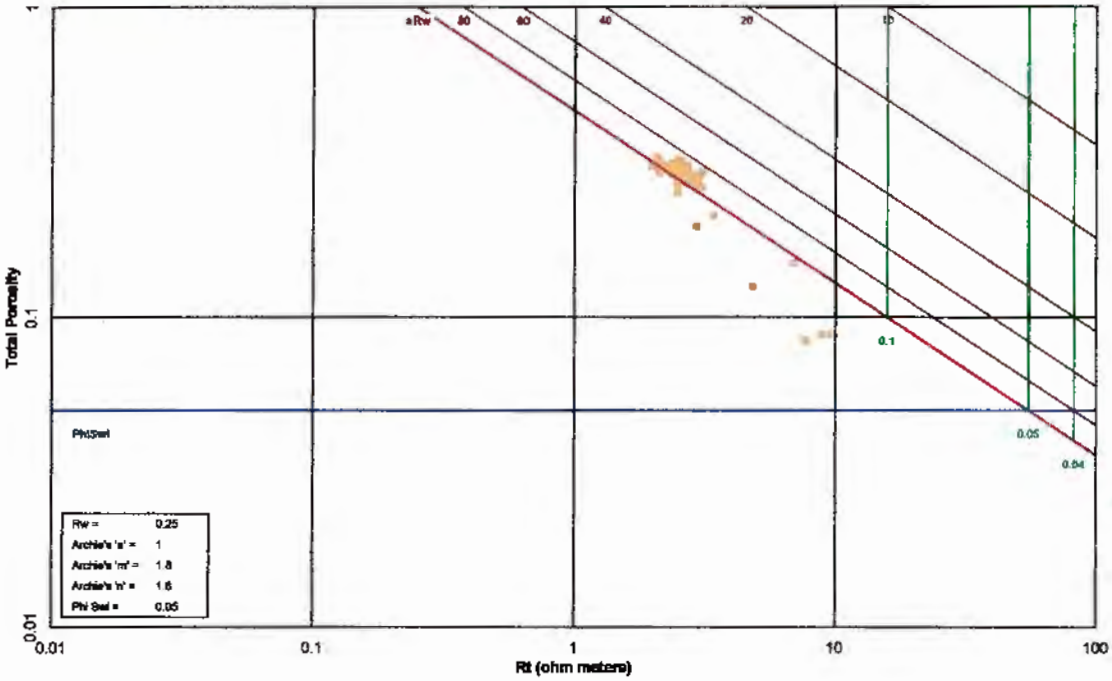
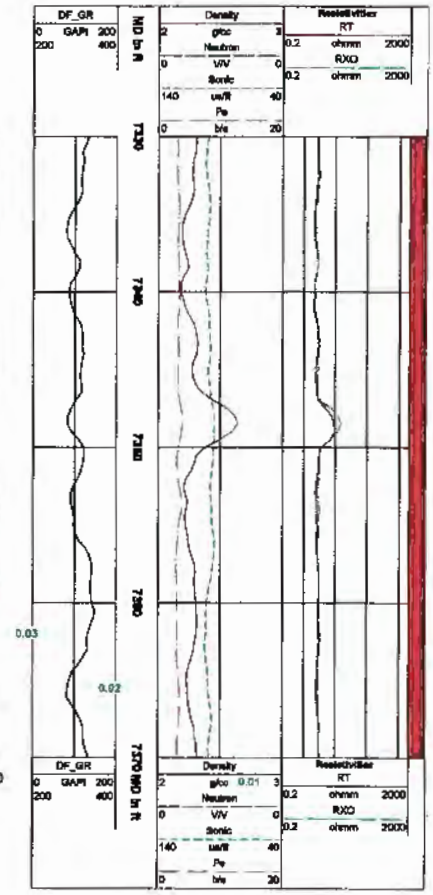
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges 7330-7370
Time: 11:01 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T 155

Rw 0.25 Sabg 13000

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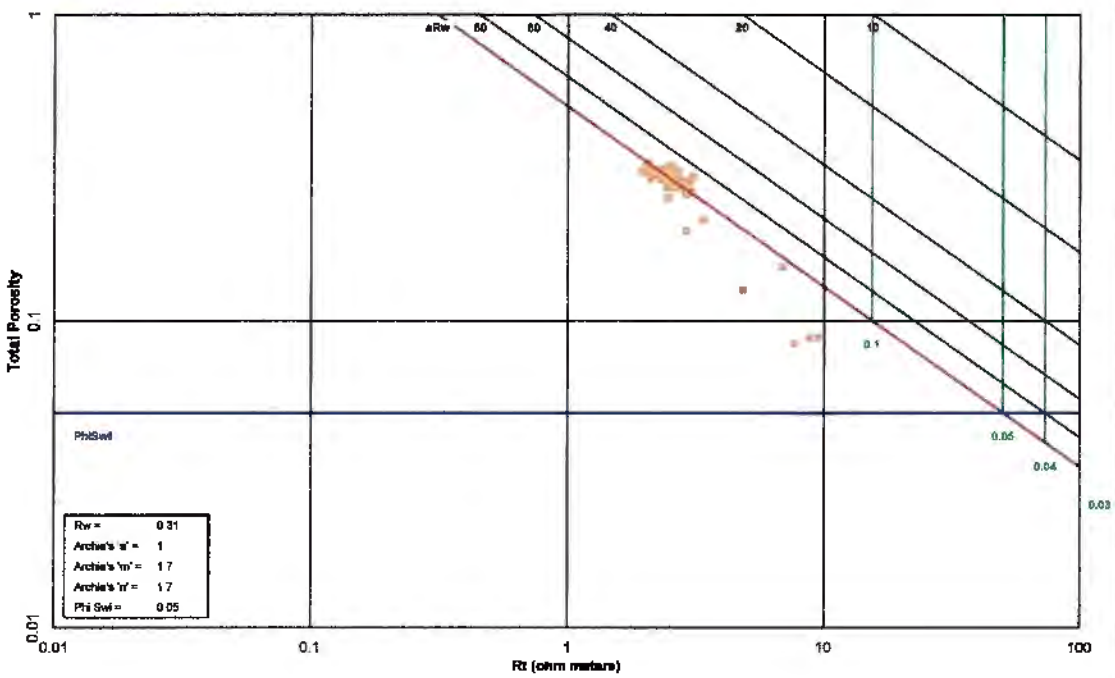
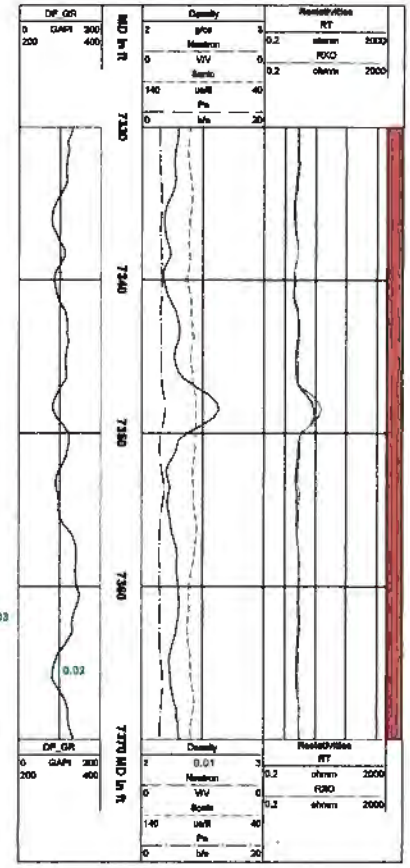
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7330-7370
Time: 10:09 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot Rw

Date: Wed Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T: 155

Rw: 0.31 5 Ag 88 ou

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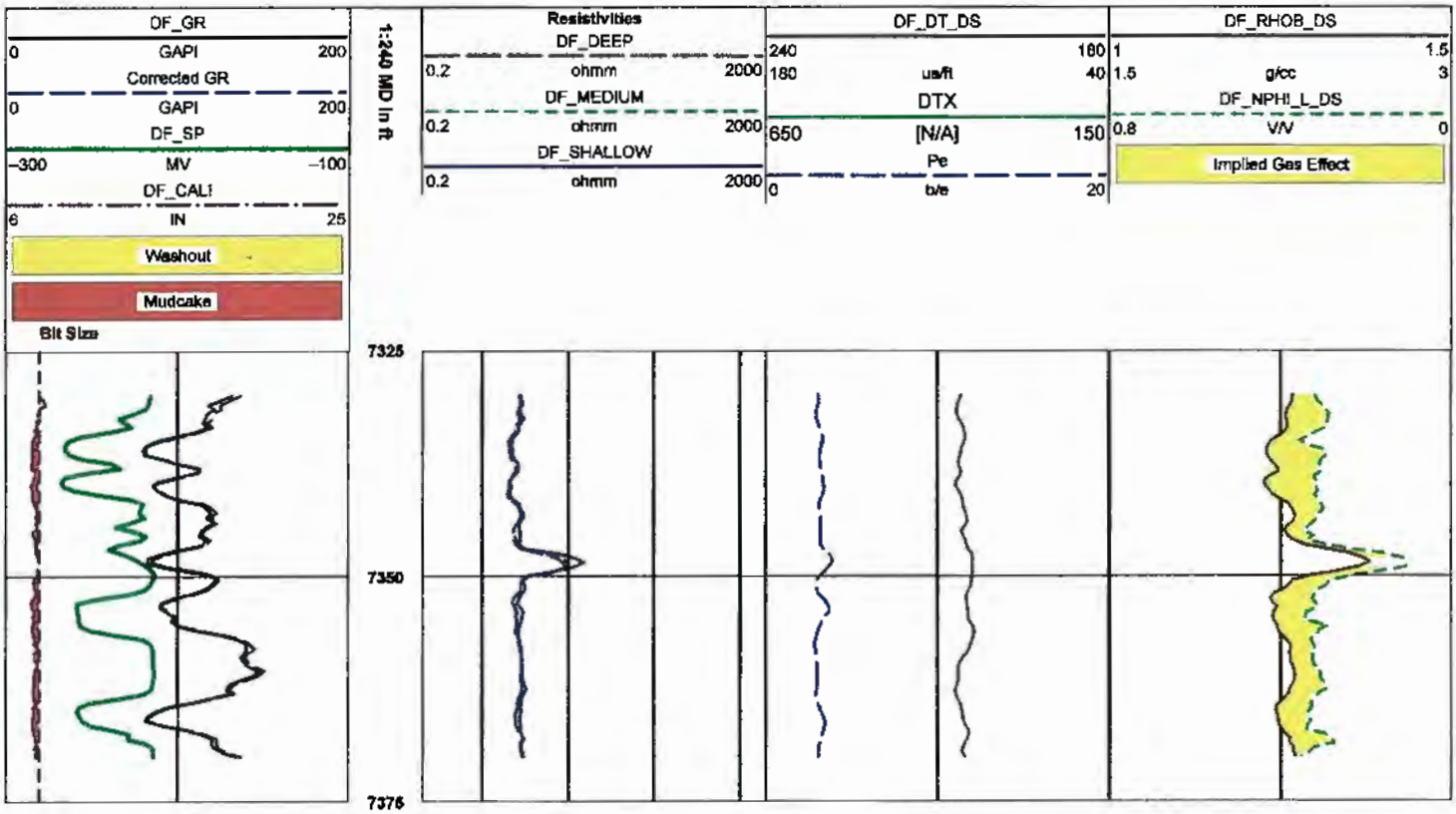
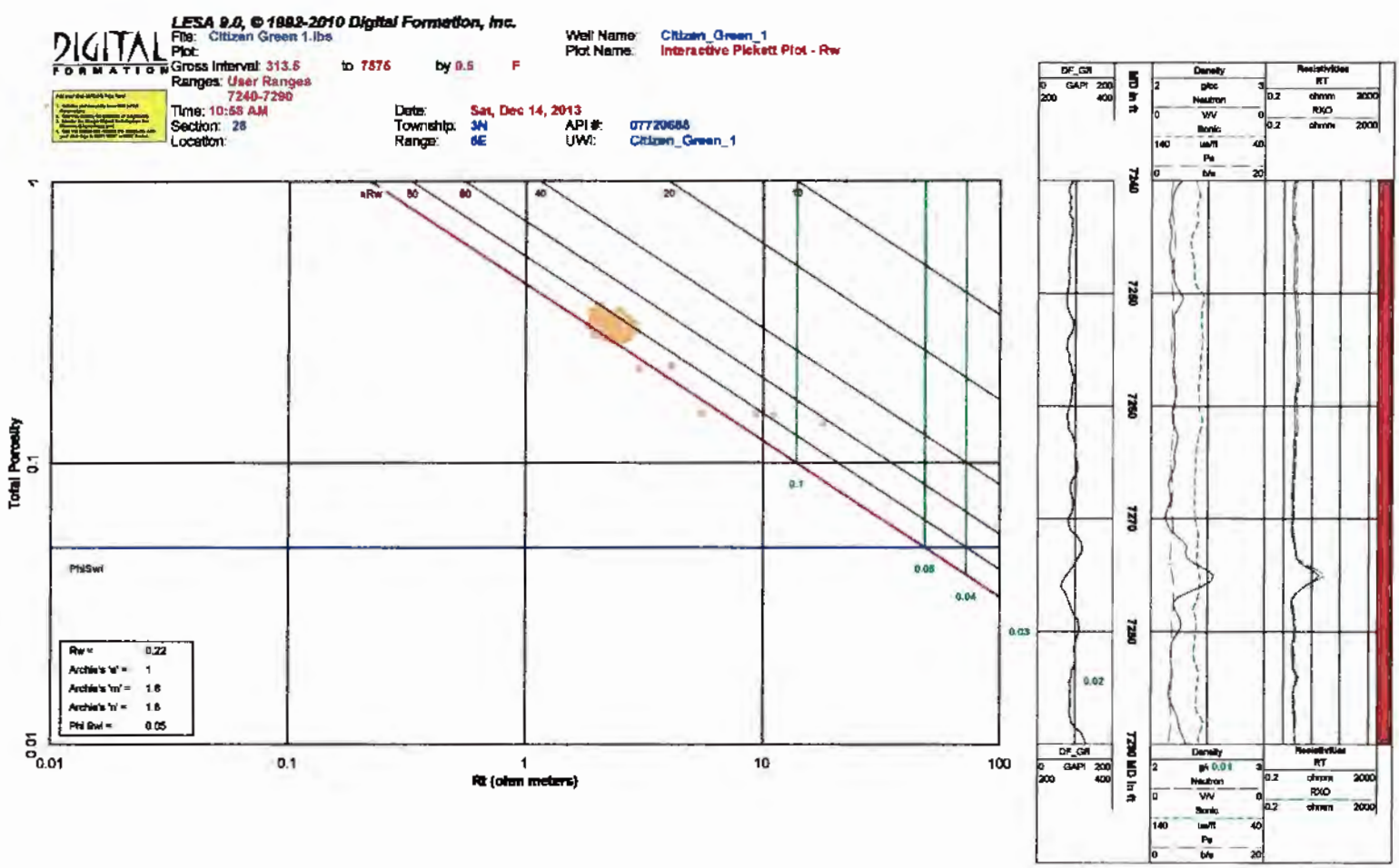
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7330-7370
Time: 10:09 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1





T 151

Rw 0.22 Salif 14000

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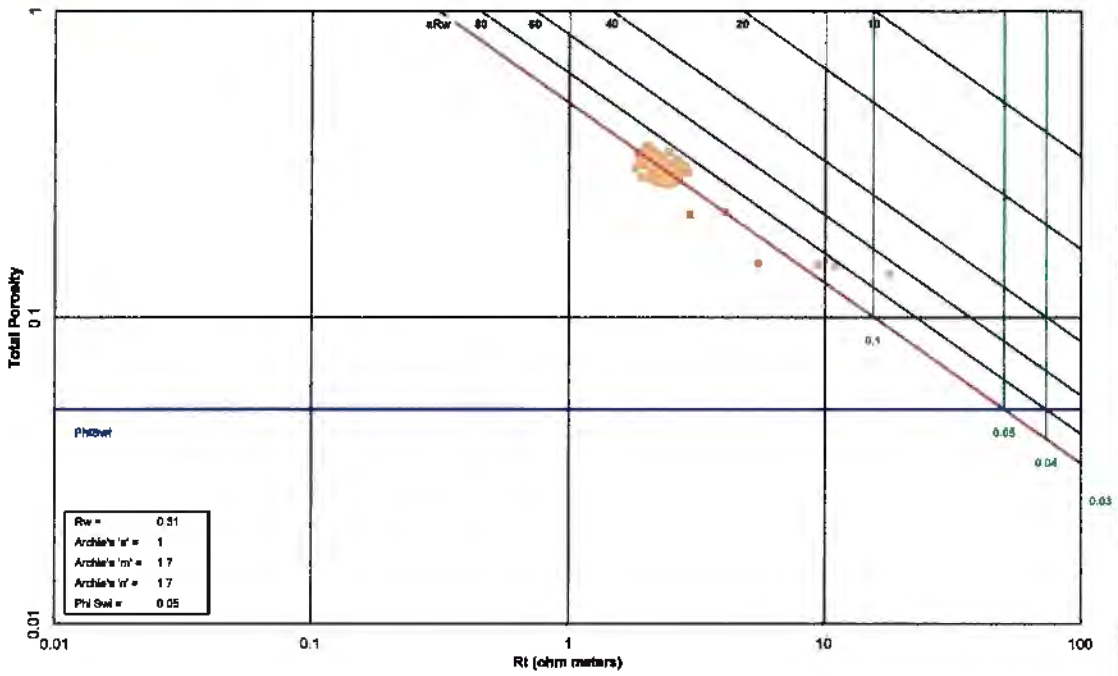
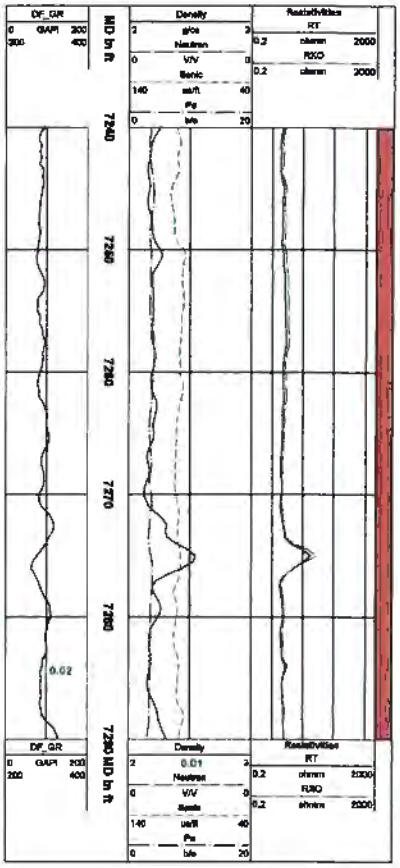
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7240-7290
Time: 10:07 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720688
Range: 5E UWI: Citizen_Green_1





T = 154

Rw = 0.31 SLB 9000

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4. Edit the object and replace the image file with your own logo in BMP, WMF or EMF format

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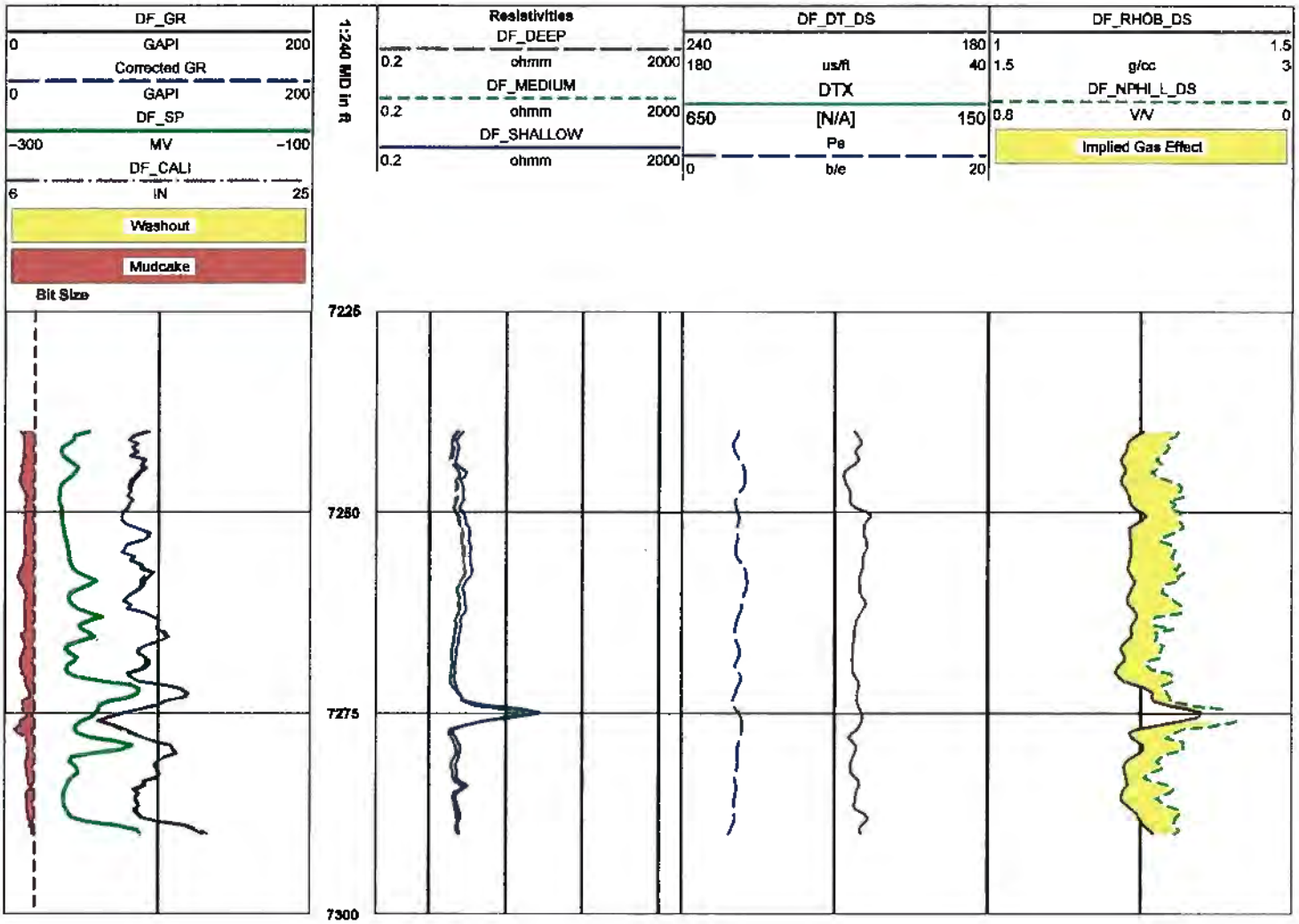
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7240-7290
Time: 10:07 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



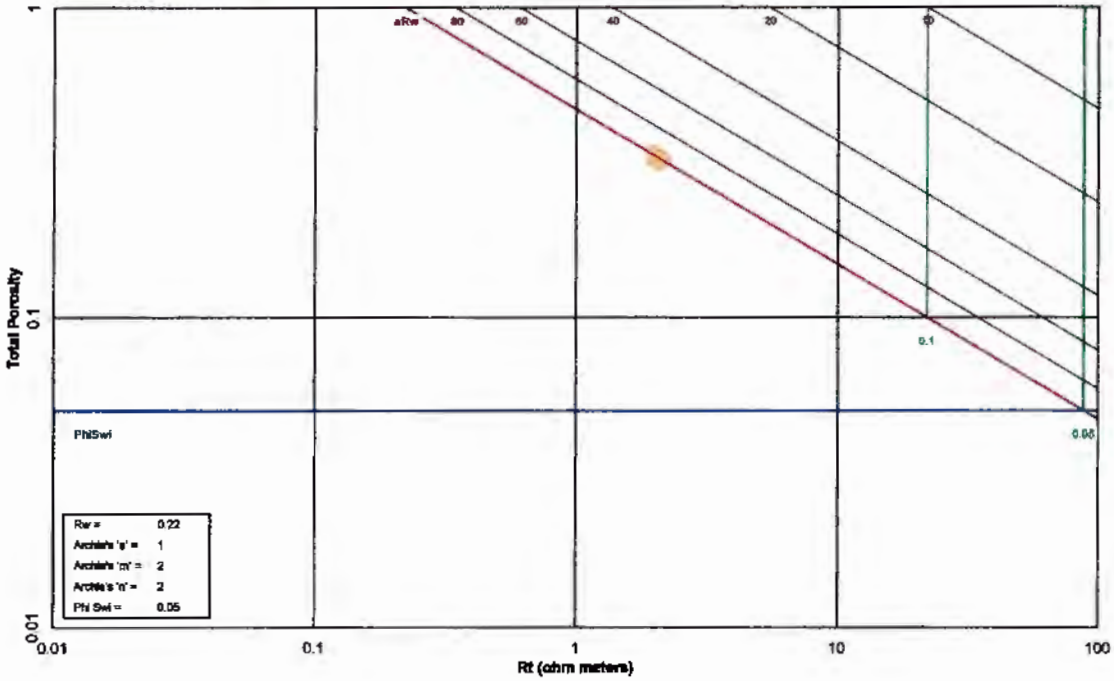
DIGITAL FORMATION

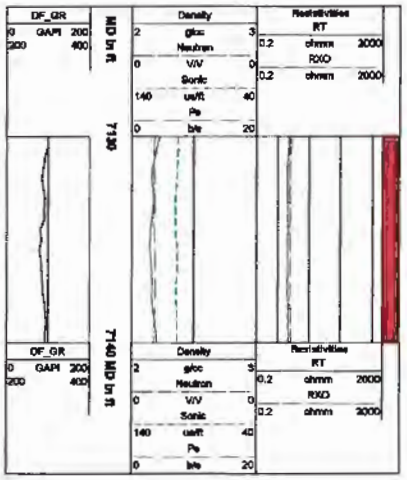
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7130-7140
Time: 10:55 AM

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N API #: 07720848
Range: 5E UWI: Citizen_Green_1
Section: 28
Location:

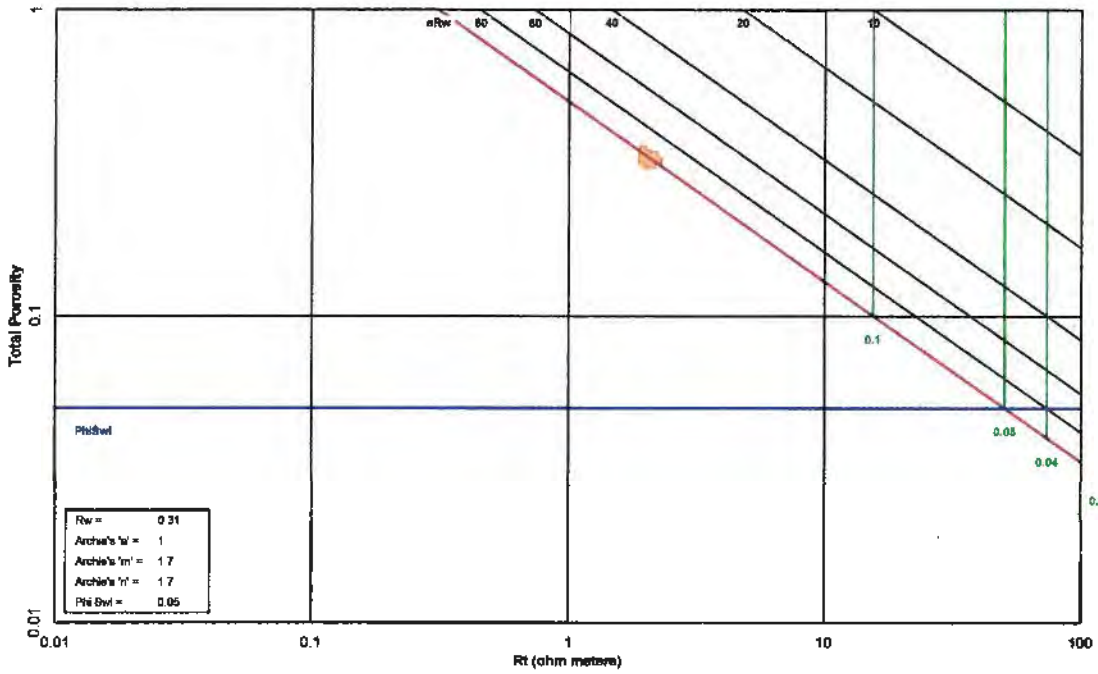


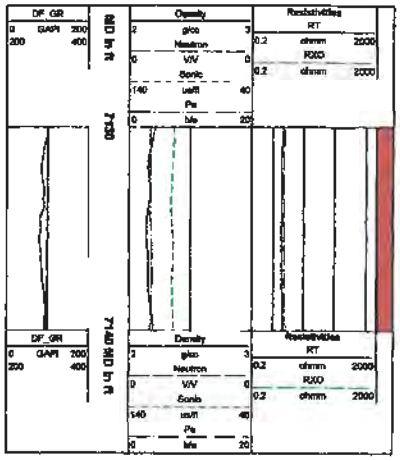


T 151

R_w 0.22 Salty 14 000

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7130-7140
Time: 10:06 AM
Section: 28
Location:
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw
API #: 07720688
UWI: Citizen_Green_1





T= 152

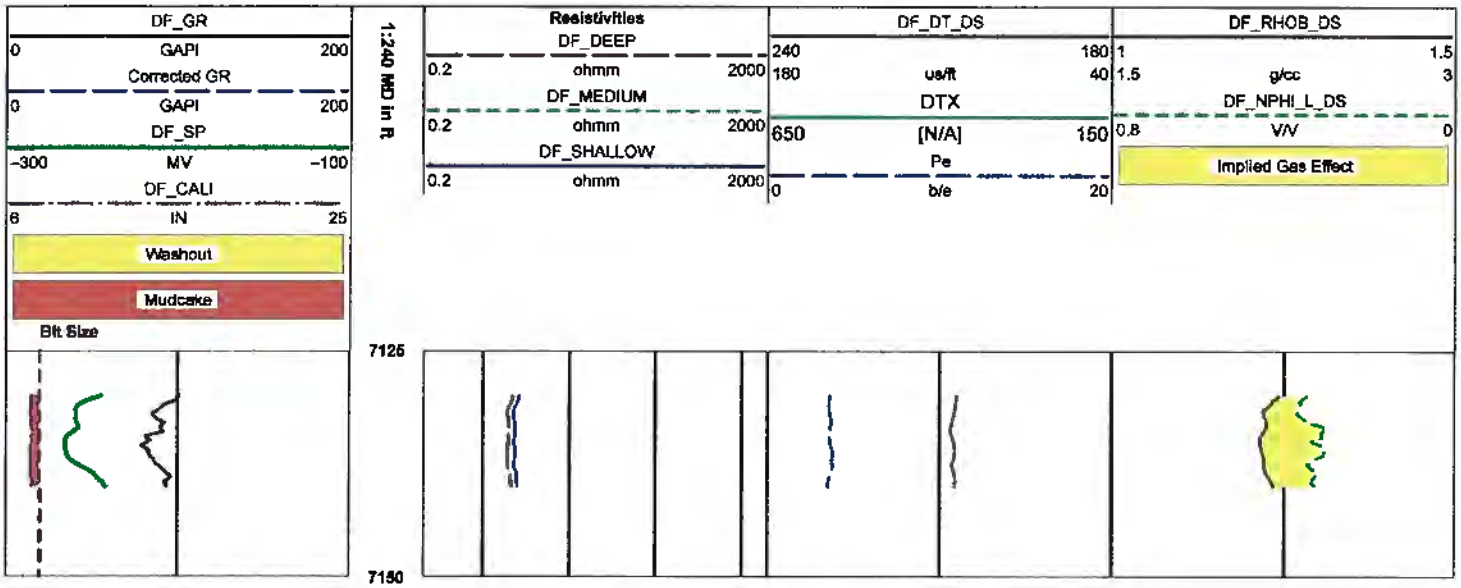
Rw: 0.31 Salg 9500

DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7130-7140
Time: 10:06 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1



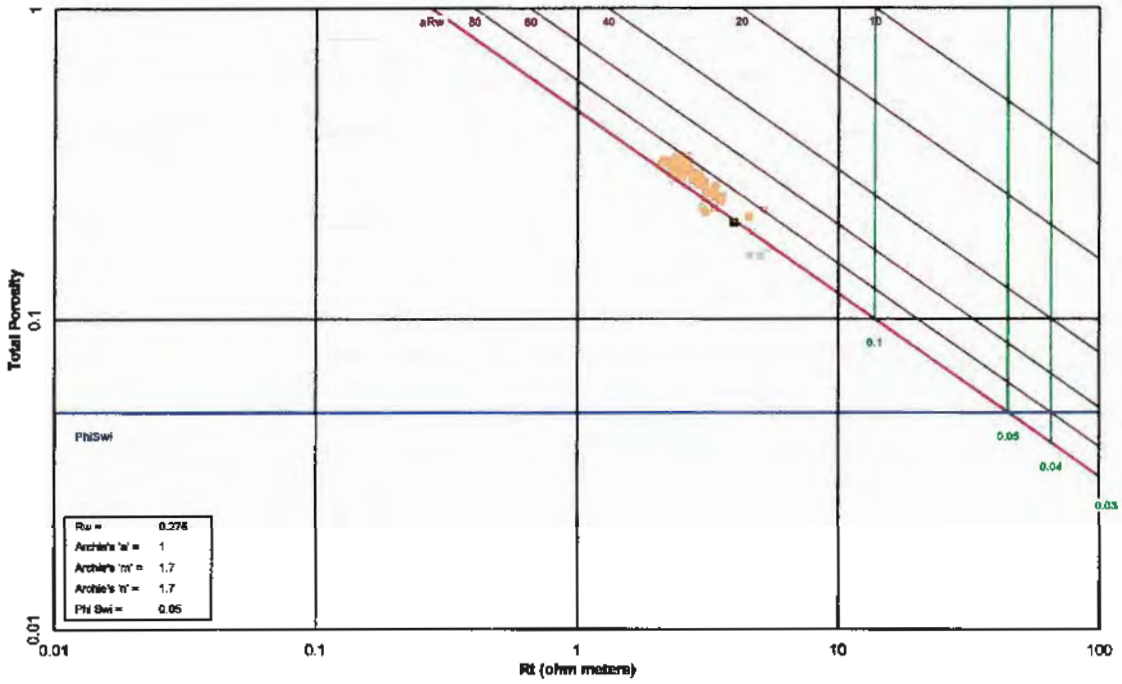
LESA 9.0, © 1992-2010 Digital Formation, Inc.

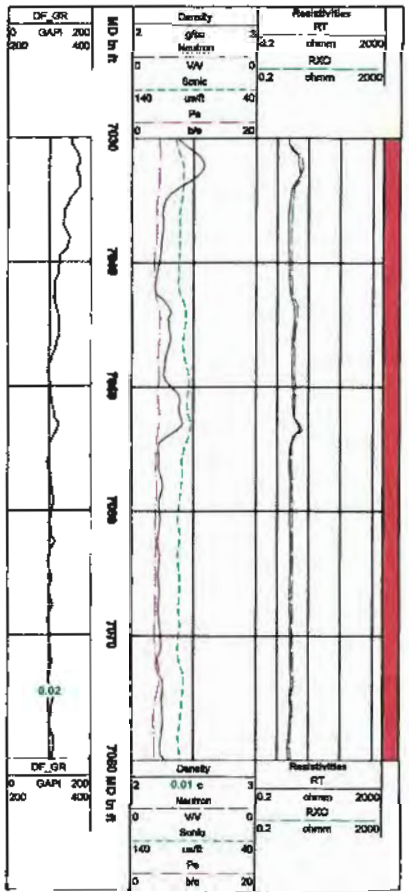
DIGITAL FORMATION

File: Citizen Green 1.dbs
Plot:
Gross Interval: 313.6 to 7575 by 0.5 F
Ranges: User Ranges
7030-7080
Time: 10:53 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

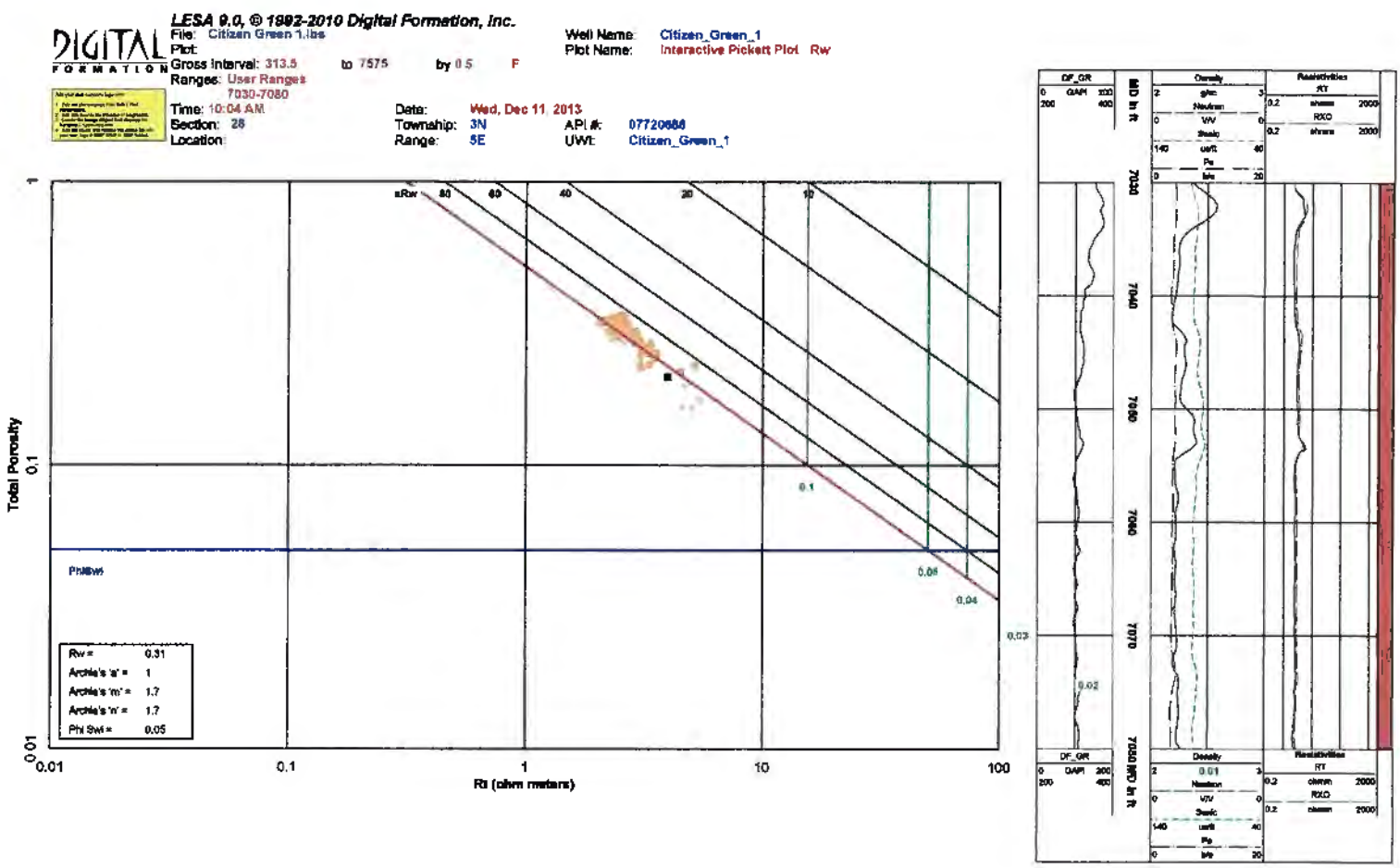
Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T 151

R_w 0.276 Salinity 11000



T = 151

Rw = 0.31 Salt 9500

DIGITAL FORMATION

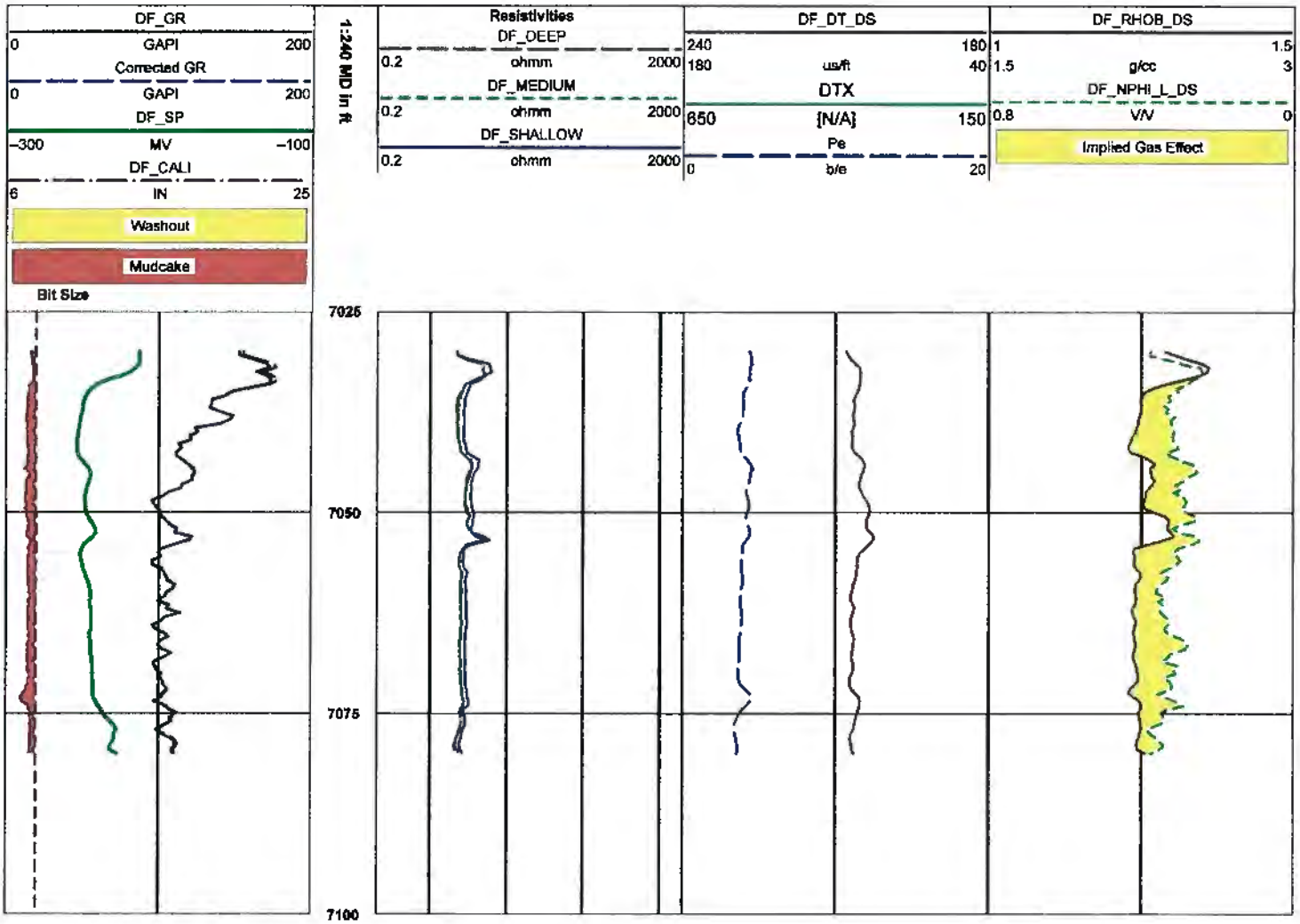
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
7030-7080
Time: 10:04 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

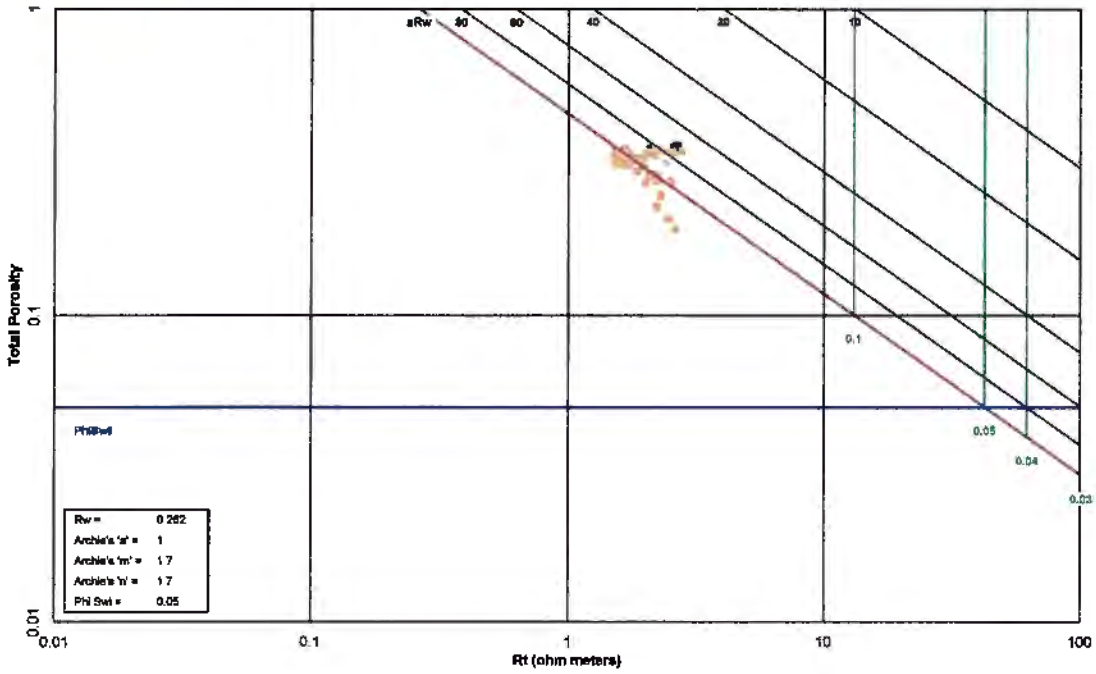


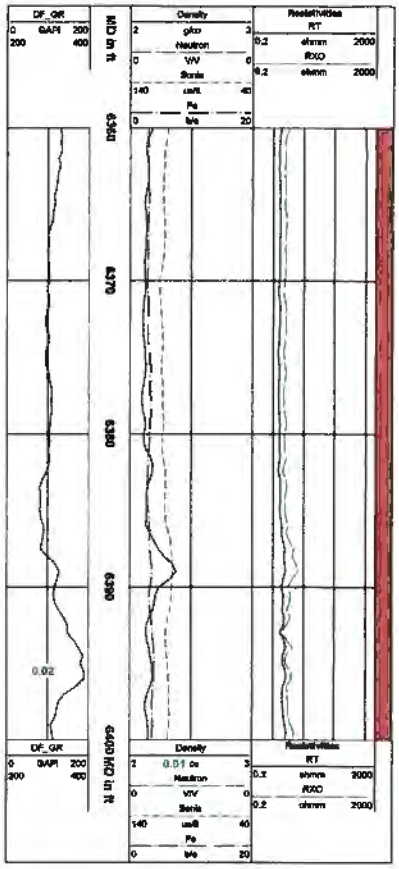
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6360-6400
Time: 10:02 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot Rw

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720658
Range: 5E UWI: Citizen_Green_1





T = 143

Rw = 0.262 Salty 14,000

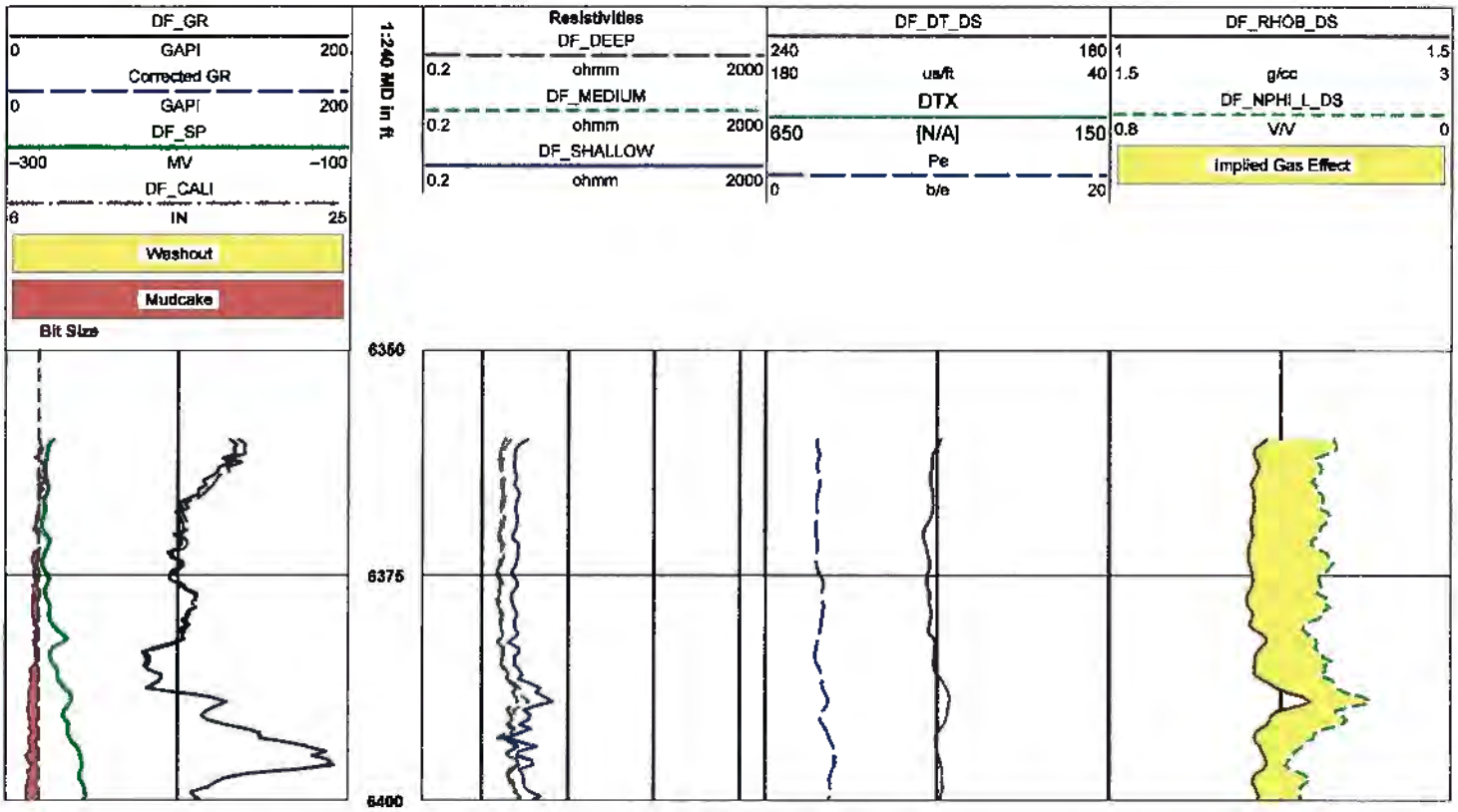
LESA 9.0, © 1992-2010 Digital Formation, Inc.

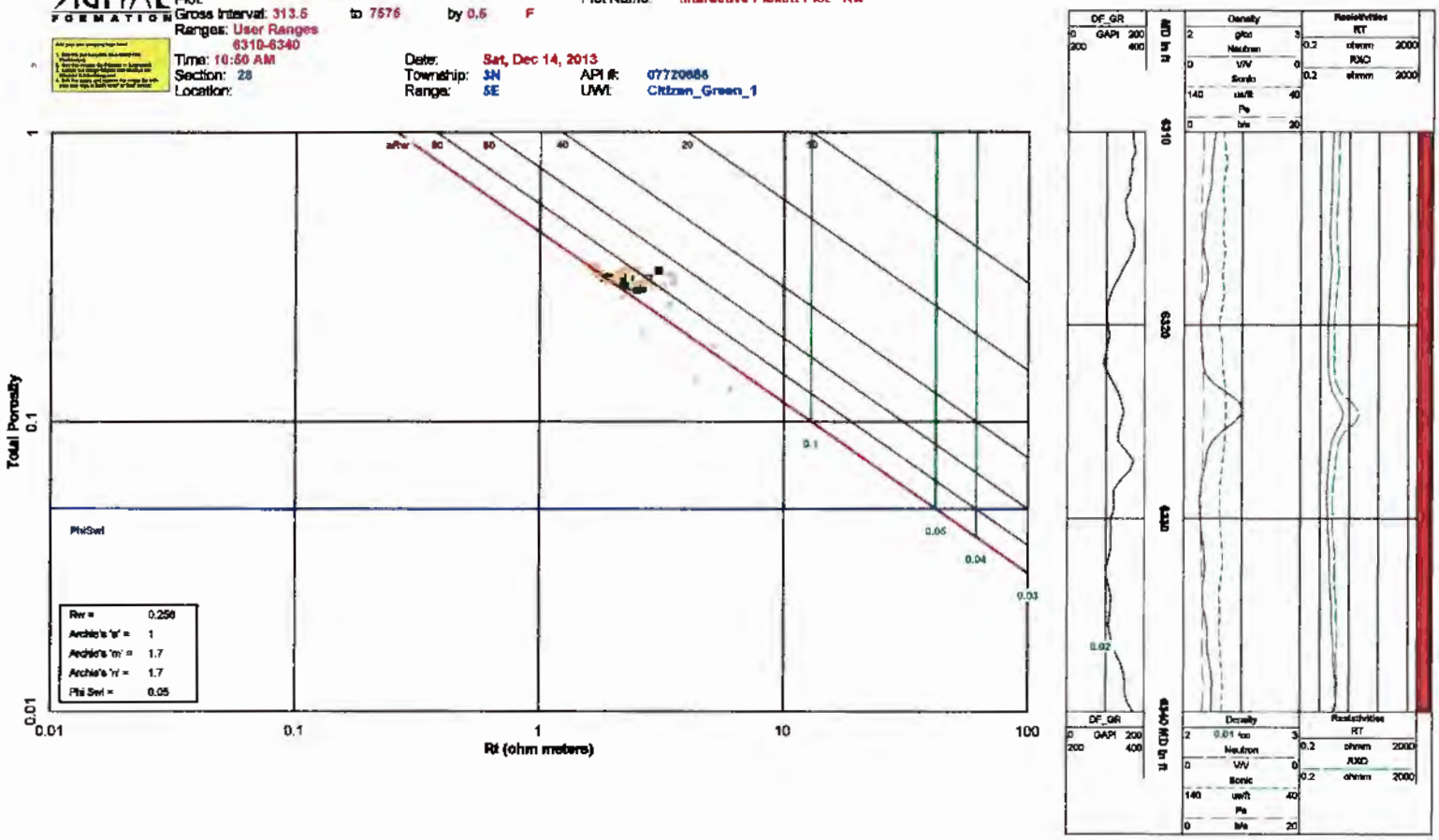
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6360-6400
Time: 10:02 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

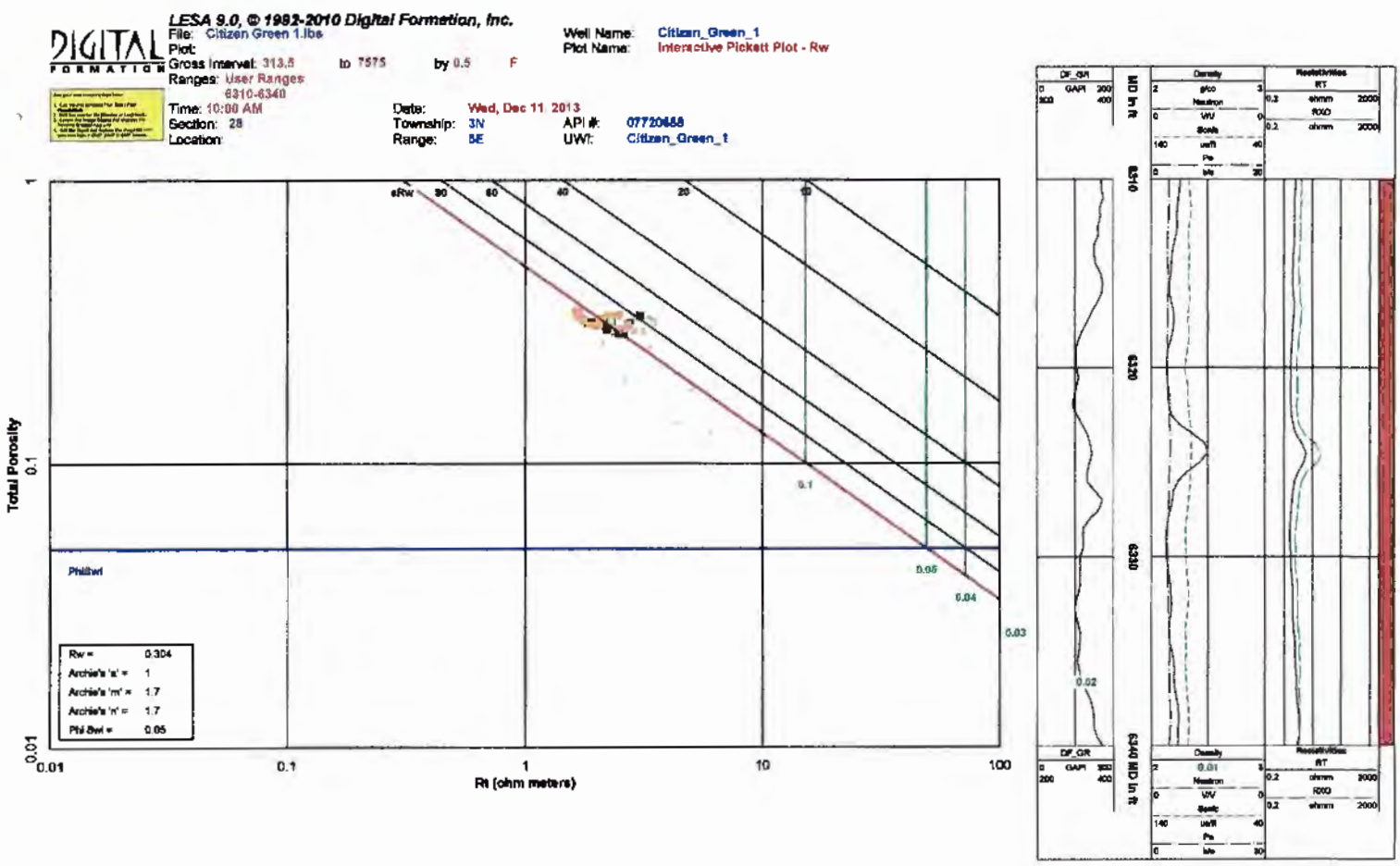
API #: 07720688
UWI: Citizen_Green_1





T = 142

Rw = 0.258 Salt 12500



T: 142

Rw: 0.304 Salty 10,000

DIGITAL FORMATION

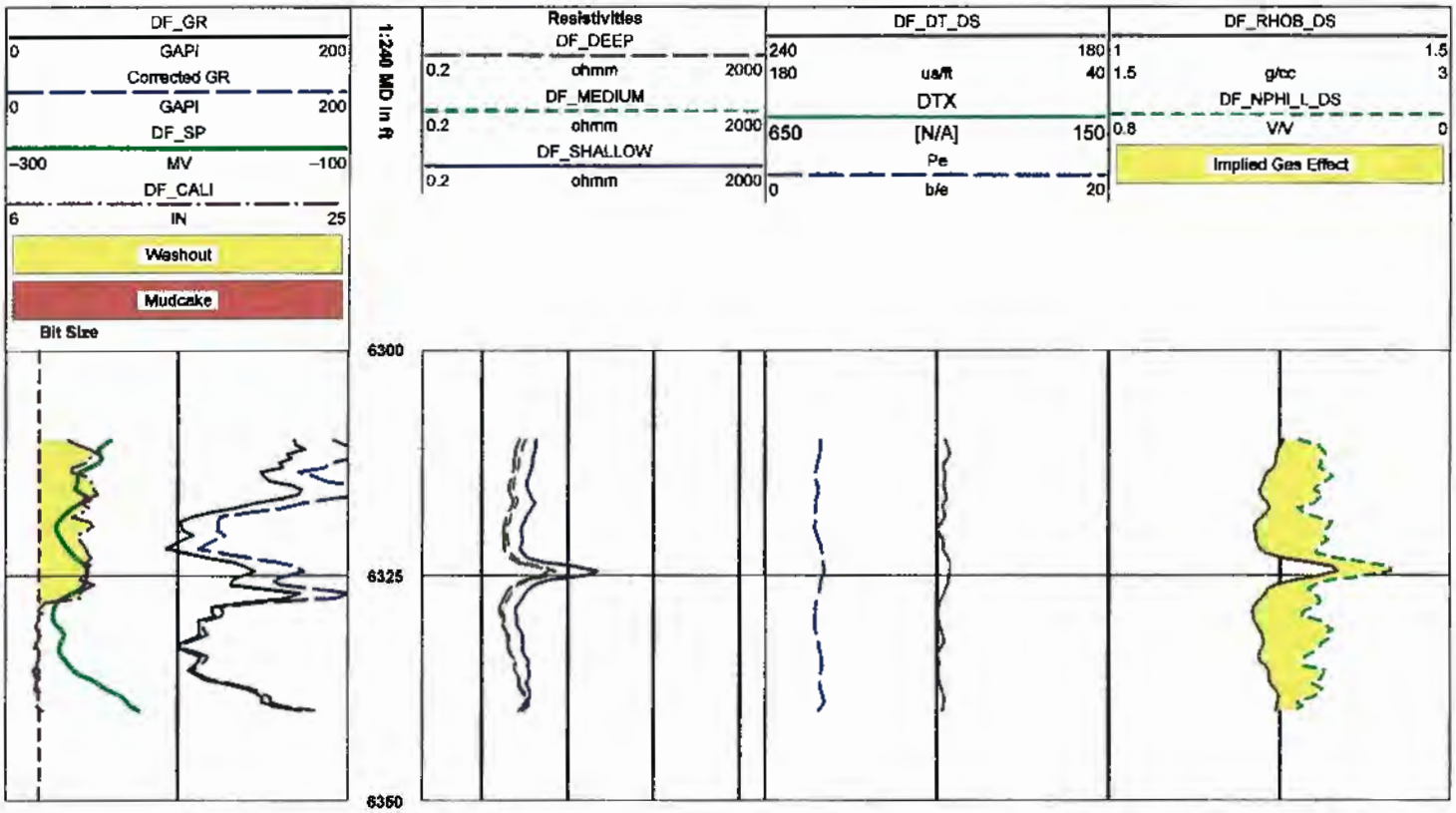
LESA 9.0, © 1992-2010 Digital Formation, Inc.

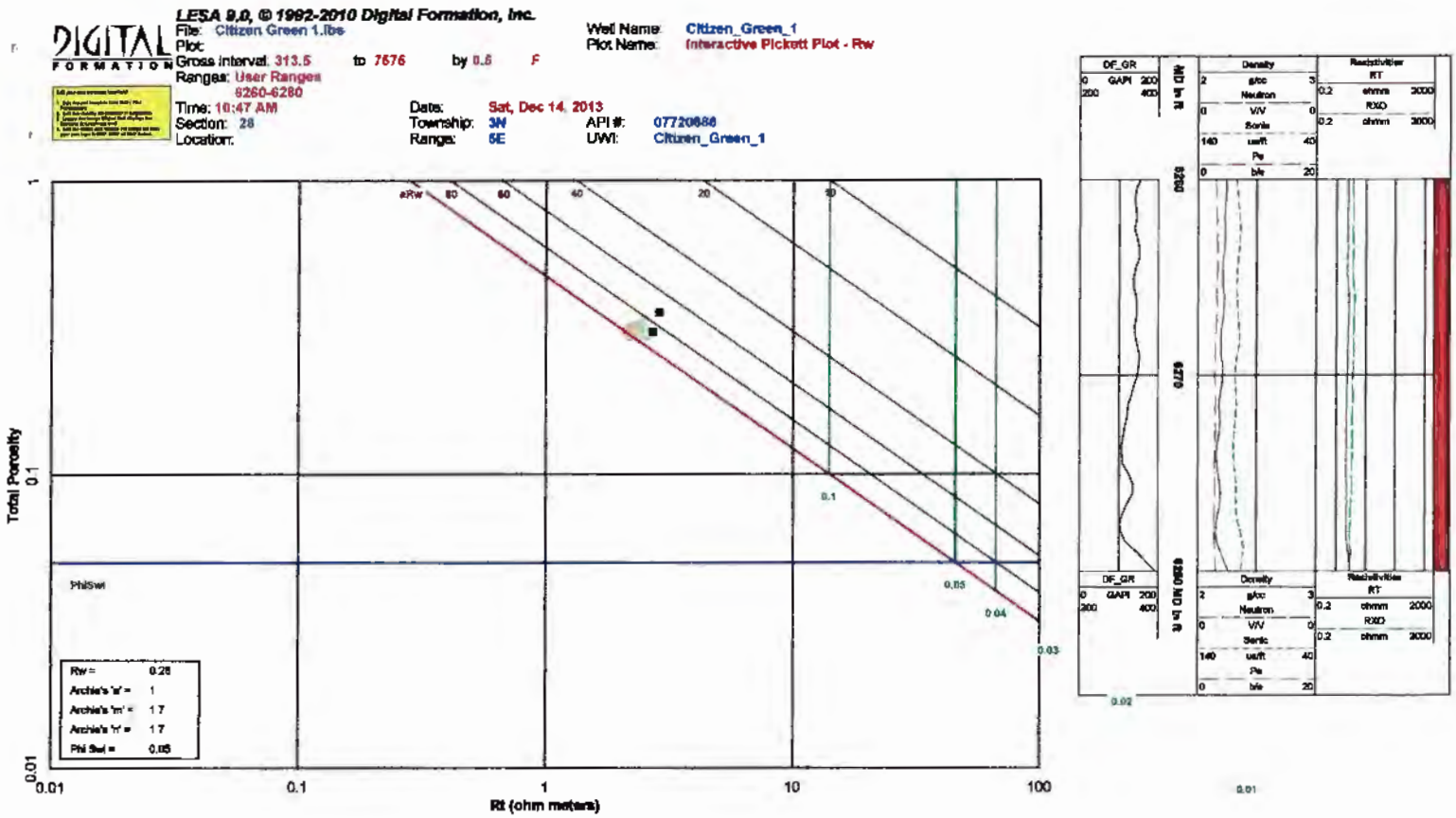
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6310-6340
Time: 09:59 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1





T 14C

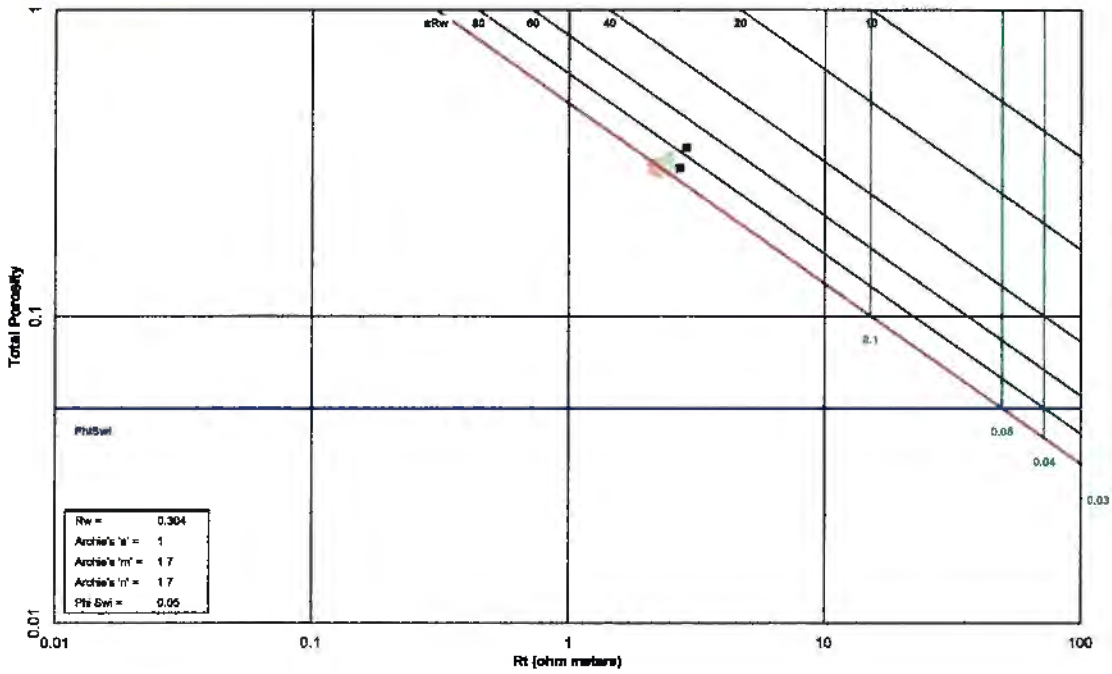
$R_w \approx 0.28$ Salinity 11,000

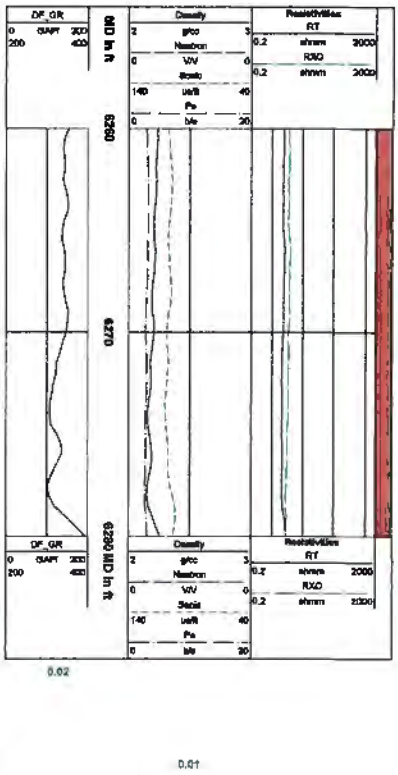
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6260-6280
Time: 09:57 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





Te 142

Rw: 0.304 Salinity 10,000

DIGITAL FORMATION

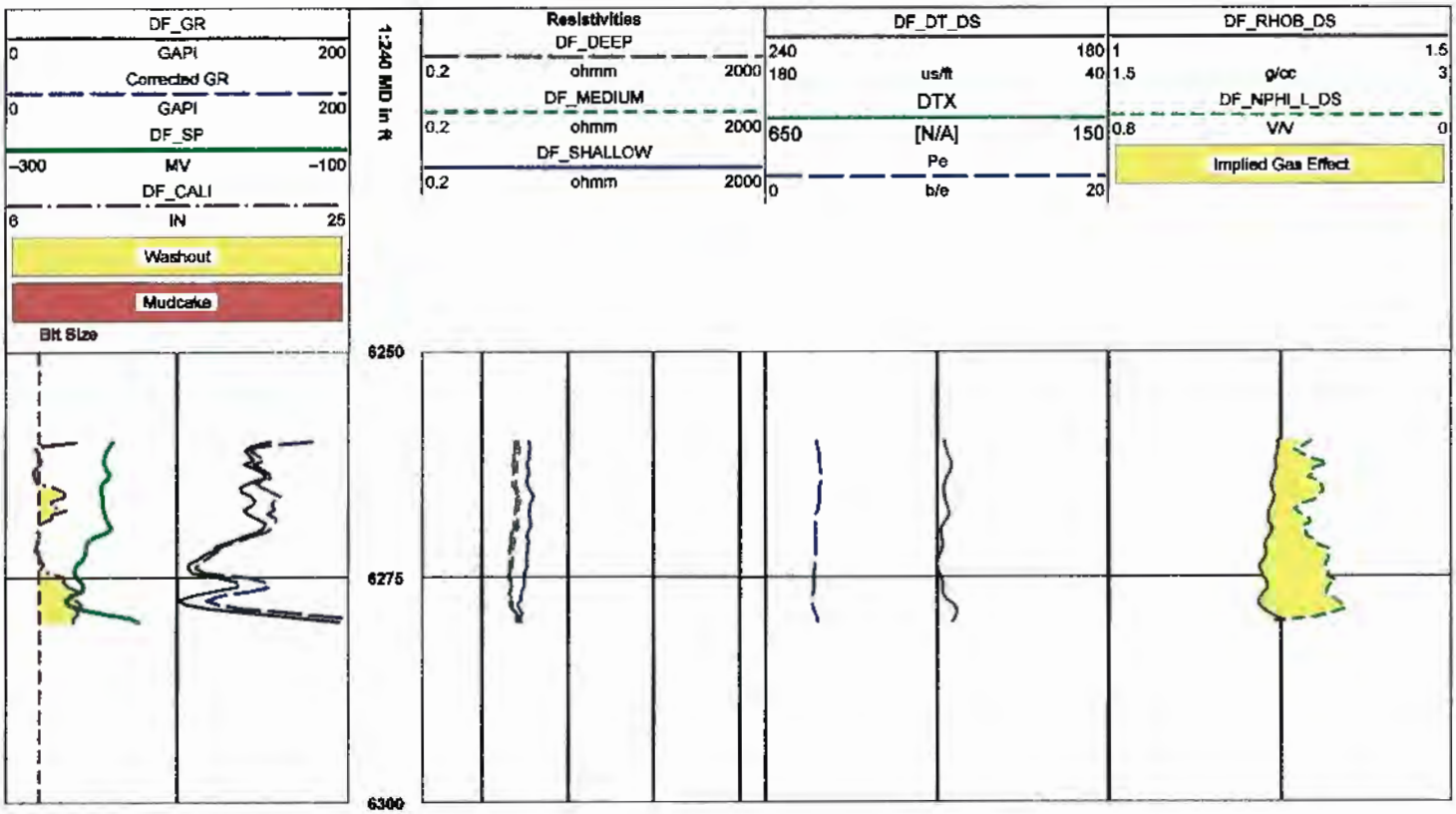
LESA 9.0, © 1992-2010 Digital Formation, Inc.

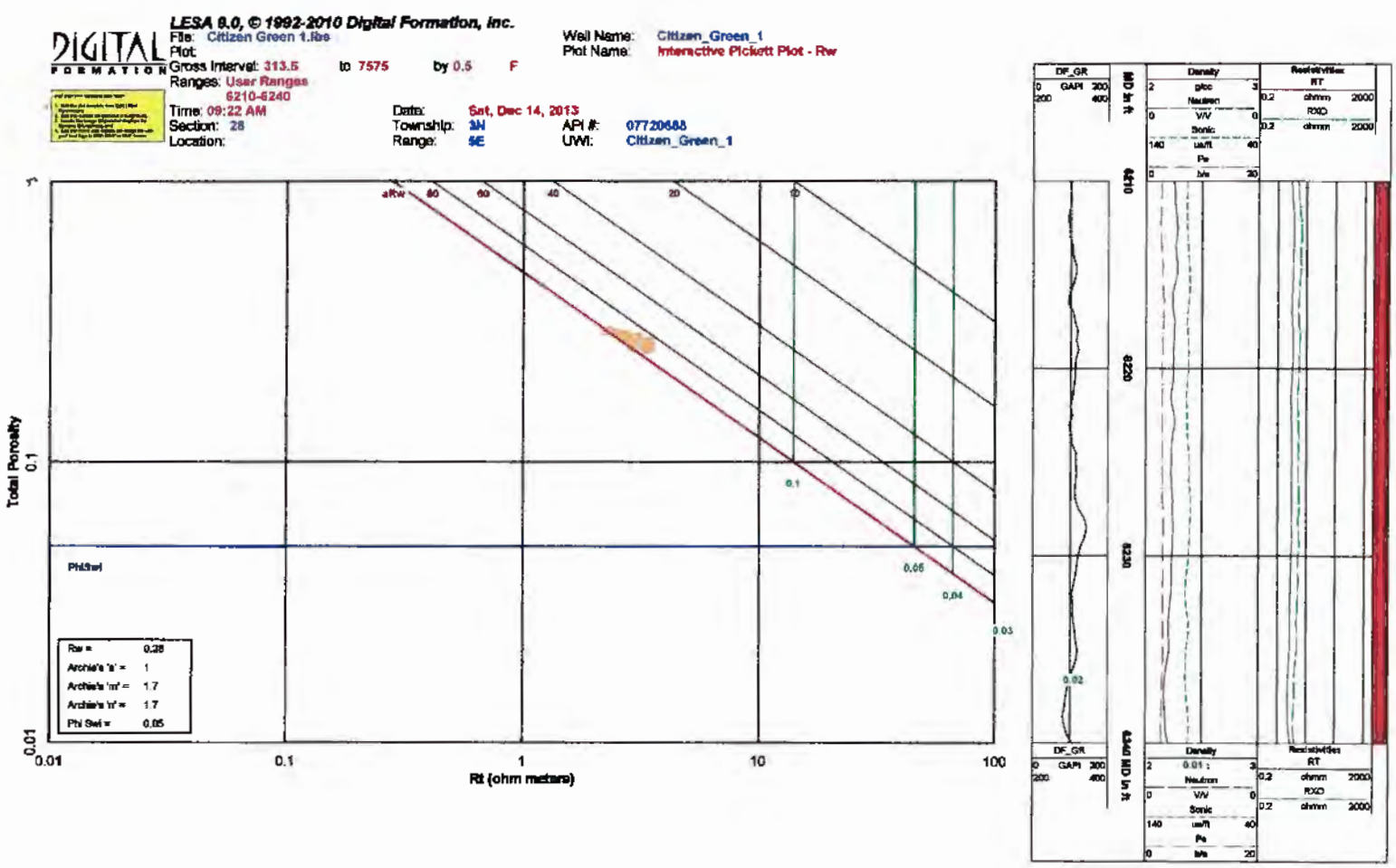
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6260-6280
Time: 09:58 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1





T 140

Rw 0.28 Salty 11,000

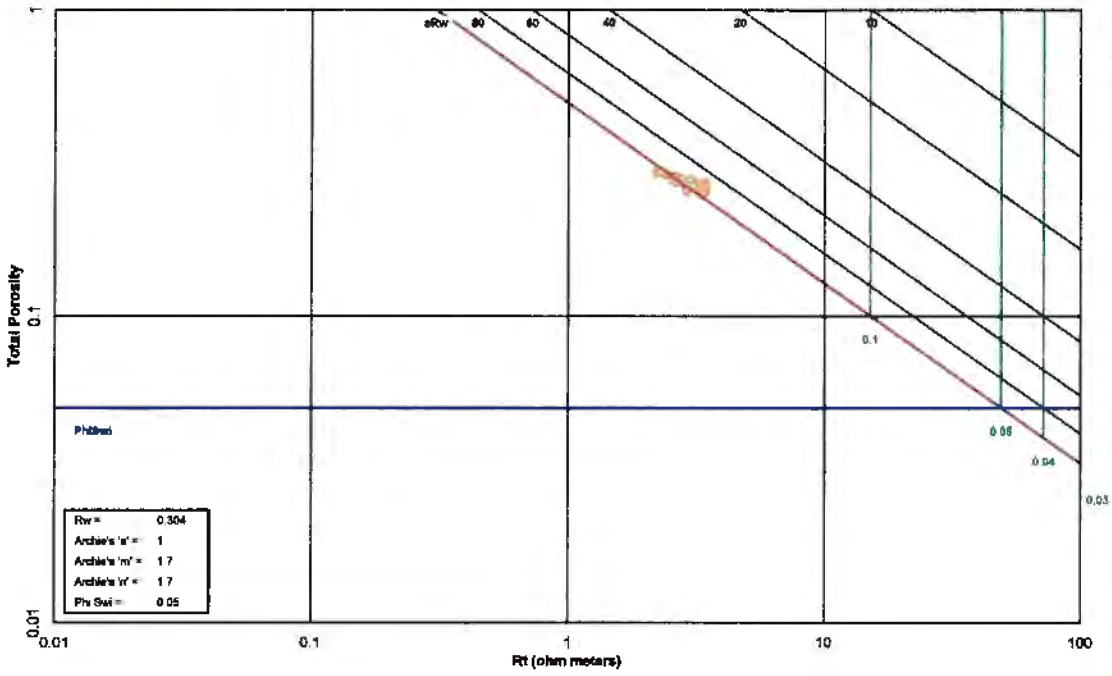
LESA 9.0, © 1992-2010 Digital Formation, Inc.

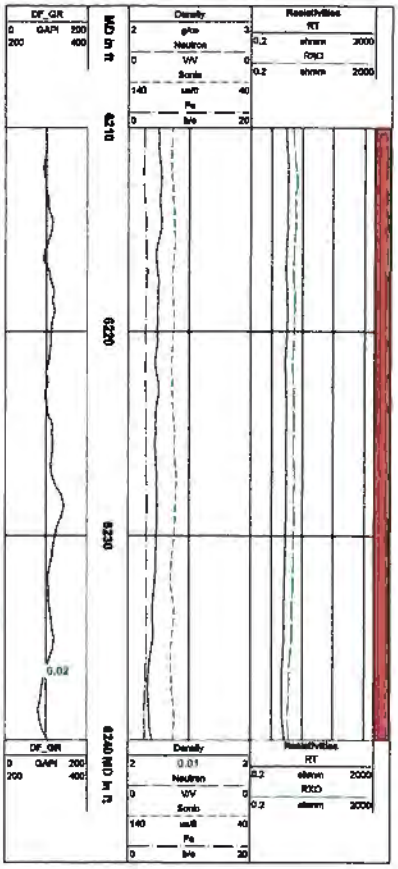
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6210-8240
Time: 09:58 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot Rw

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720668
Range: 5E UWI: Citizen_Green_1





T = 140

Rw = 0.304 Salinity 10,000

DIGITAL FORMATION

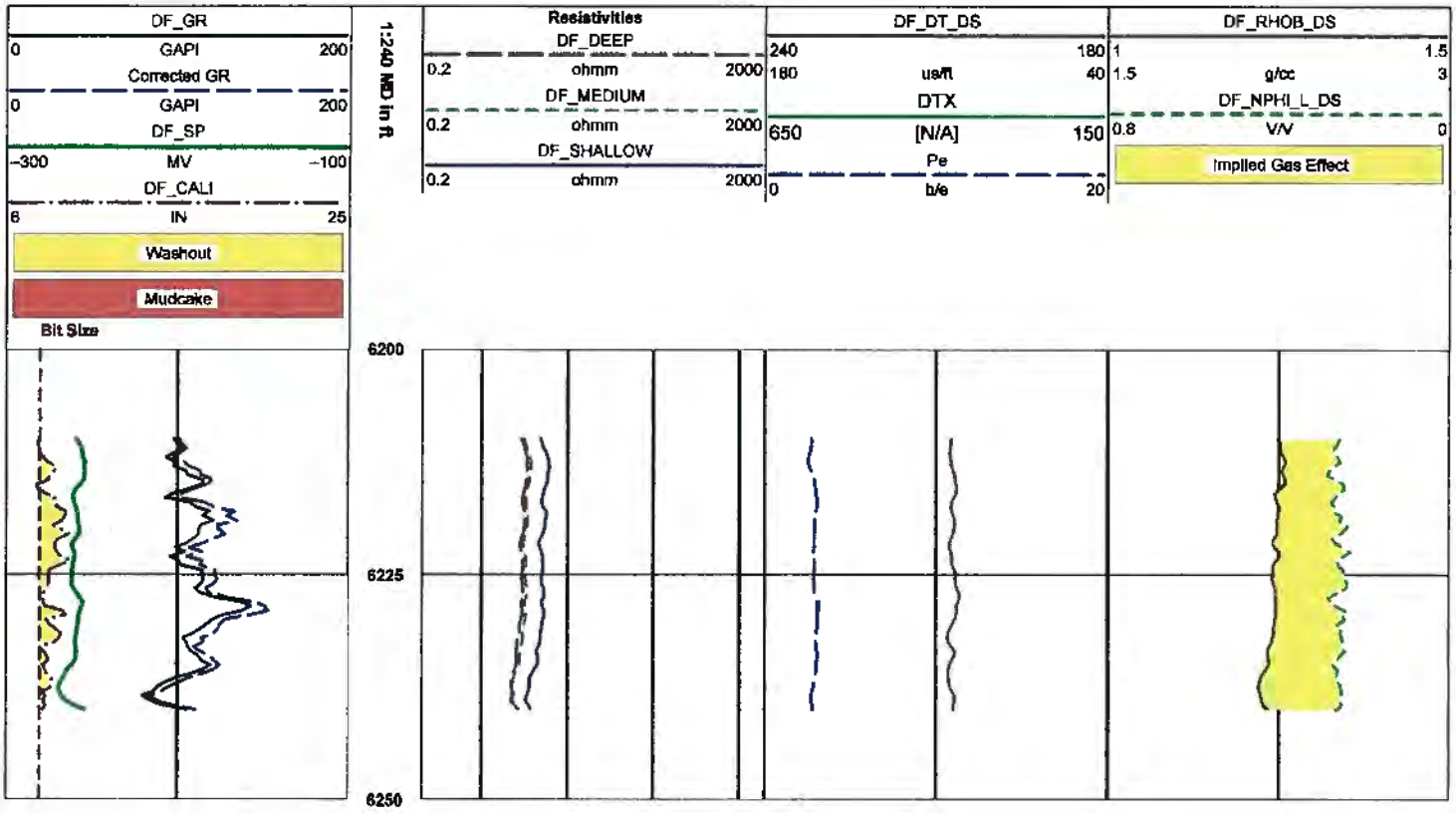
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6210-6240
Time: 09:55 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



LESA 9.0, © 1992-2010 Digital Formation, Inc.

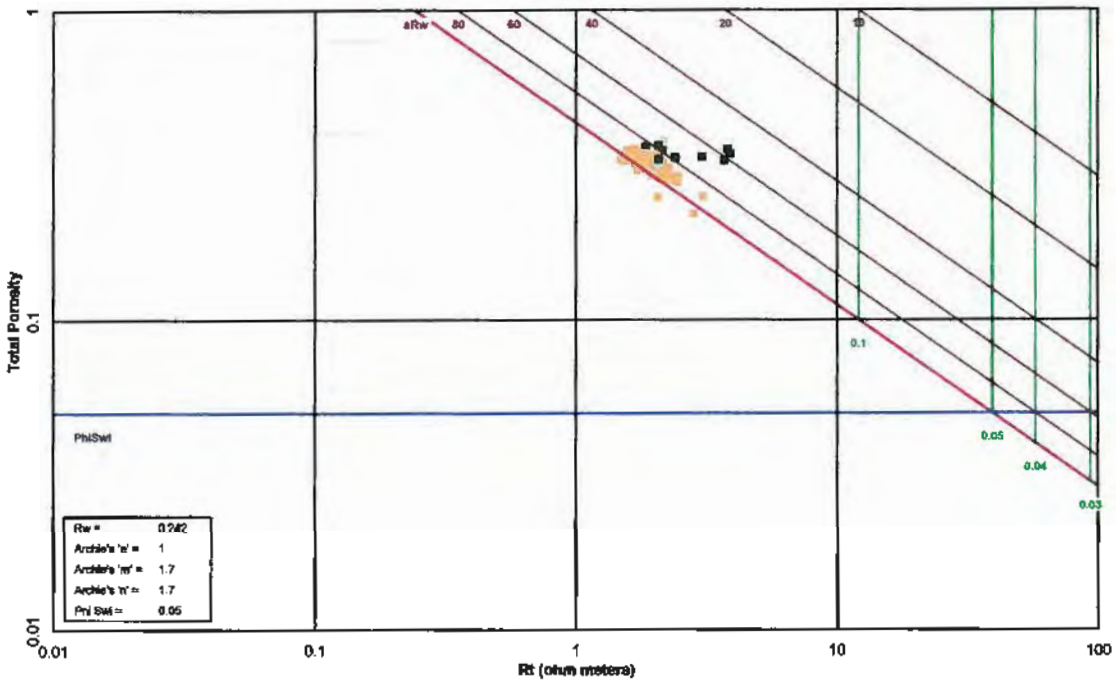
DIGITAL FORMATION

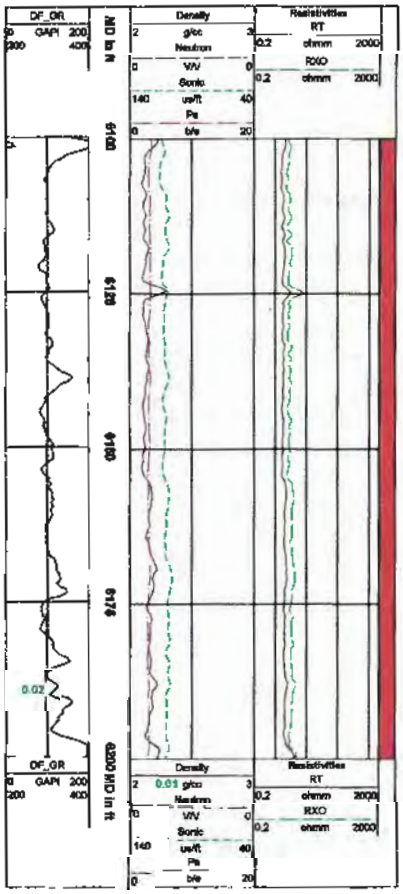
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7675 by 0.5 F
Ranges: User Ranges
5100-6200
Time: 09:18 AM
Section: 28
Location:

Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

API #: 07720688
UWI: Citizen_Green_1





T 140

Rw 0.242 Salty 1400 ppm

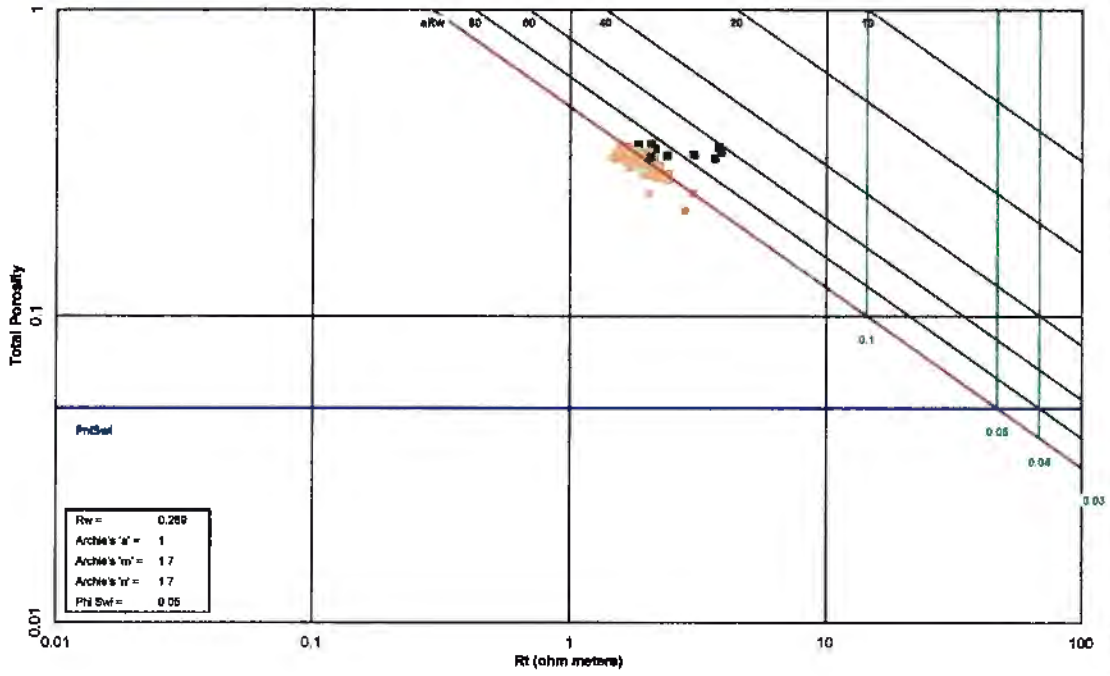
LESA 9.0, © 1992-2010 Digital Formation, Inc.

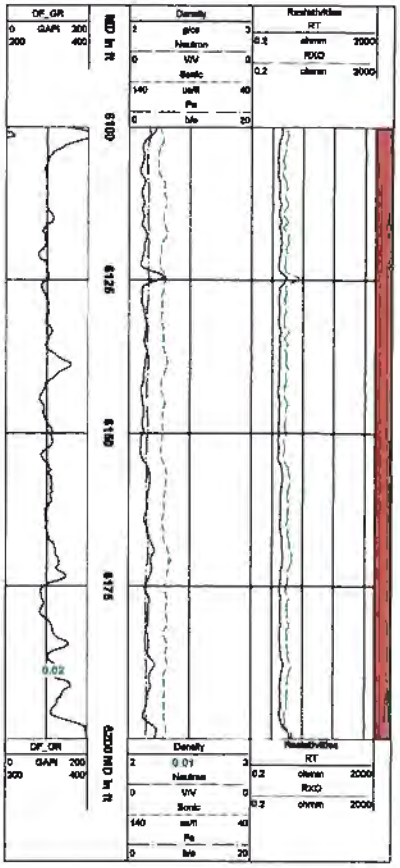
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6100-6200
Time: 09:52 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot : Rw

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720688
Range: 5E UWI: Citizen_Green_1





T. 140

Rw = 0.269 Salinity 11000

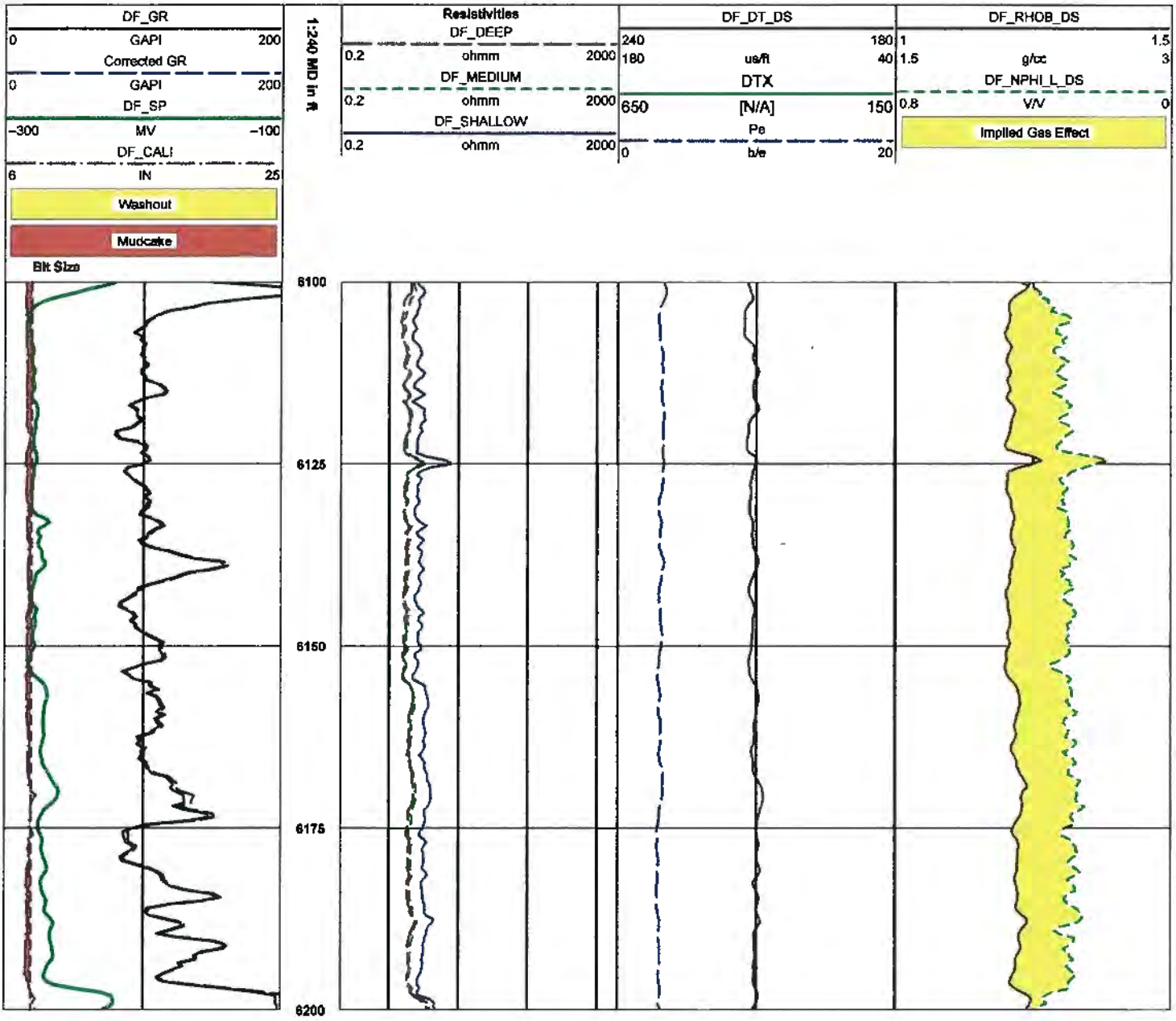
LESA 9.0, © 1992-2010 Digital Formation, Inc.

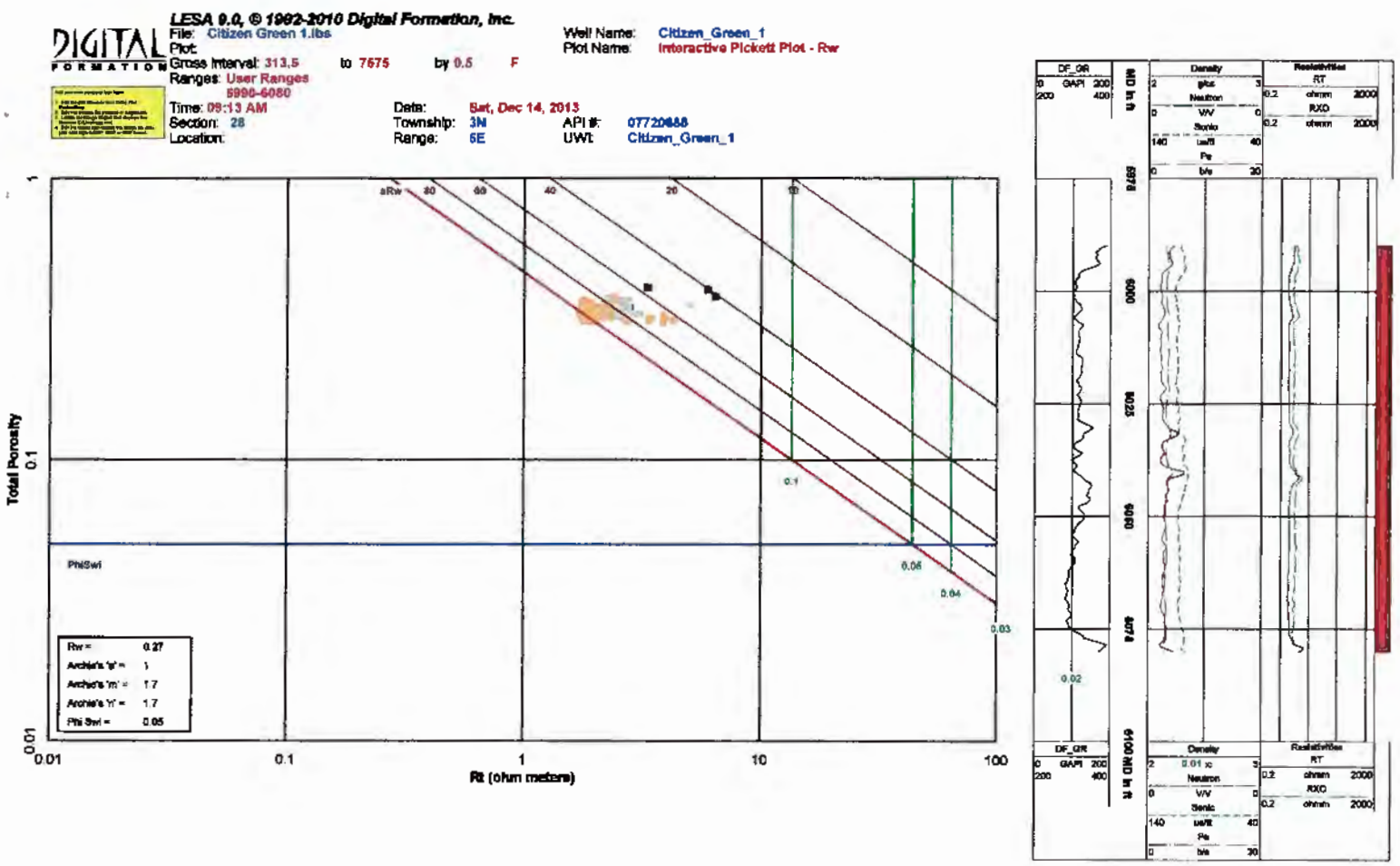
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6100-6200
Time: 09:52 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1





T 138

Rw 0.27 Salinity 12000

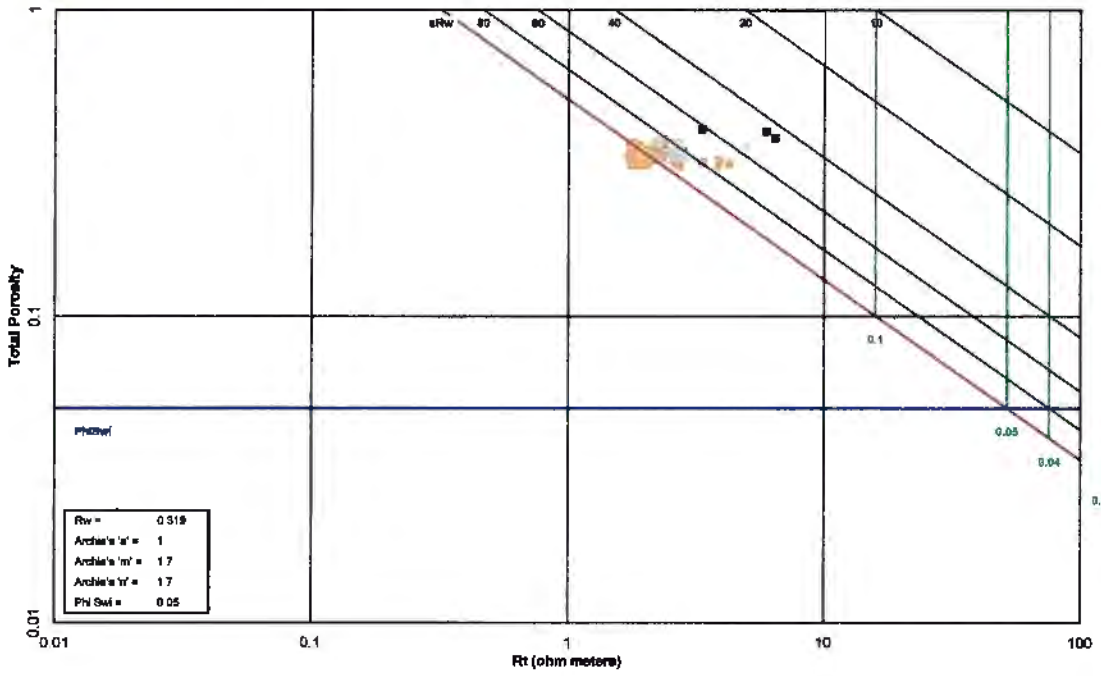
LESA 9.0, © 1992-2010 Digital Formation, Inc.

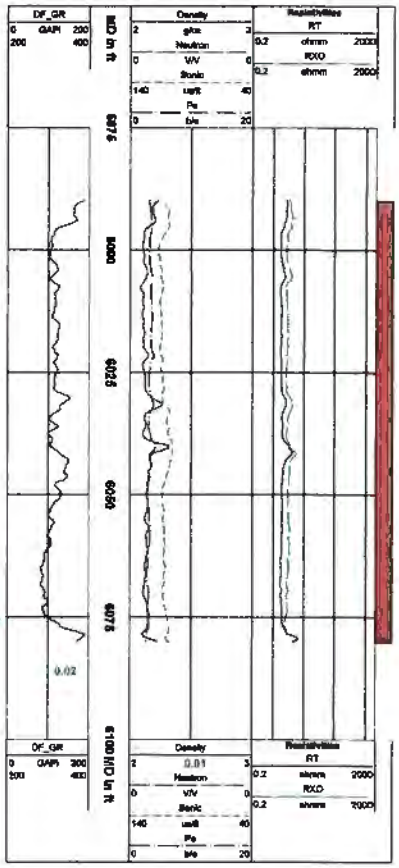
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5990-6080
Time: 09:49 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot Rw

Date: Wed, Dec 11 2013
Township: 3N
Range: 5E
API #: 07720686
UWI: Citizen_Green_1





T= 138

R_w = 0.319 Salt 10,000

DIGITAL FORMATION

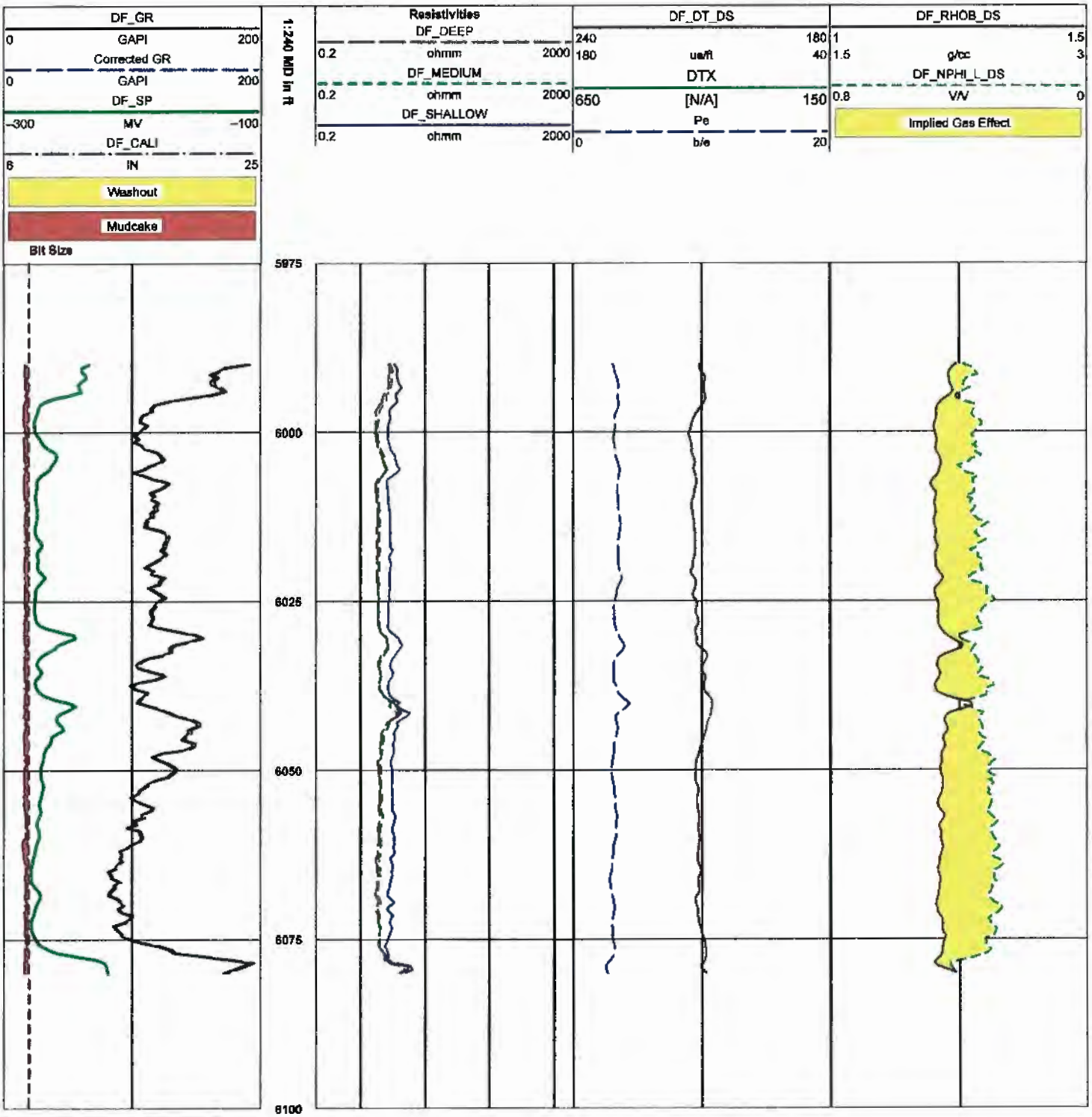
LESA 9.0, © 1992-2010 Digital Formation, Inc.

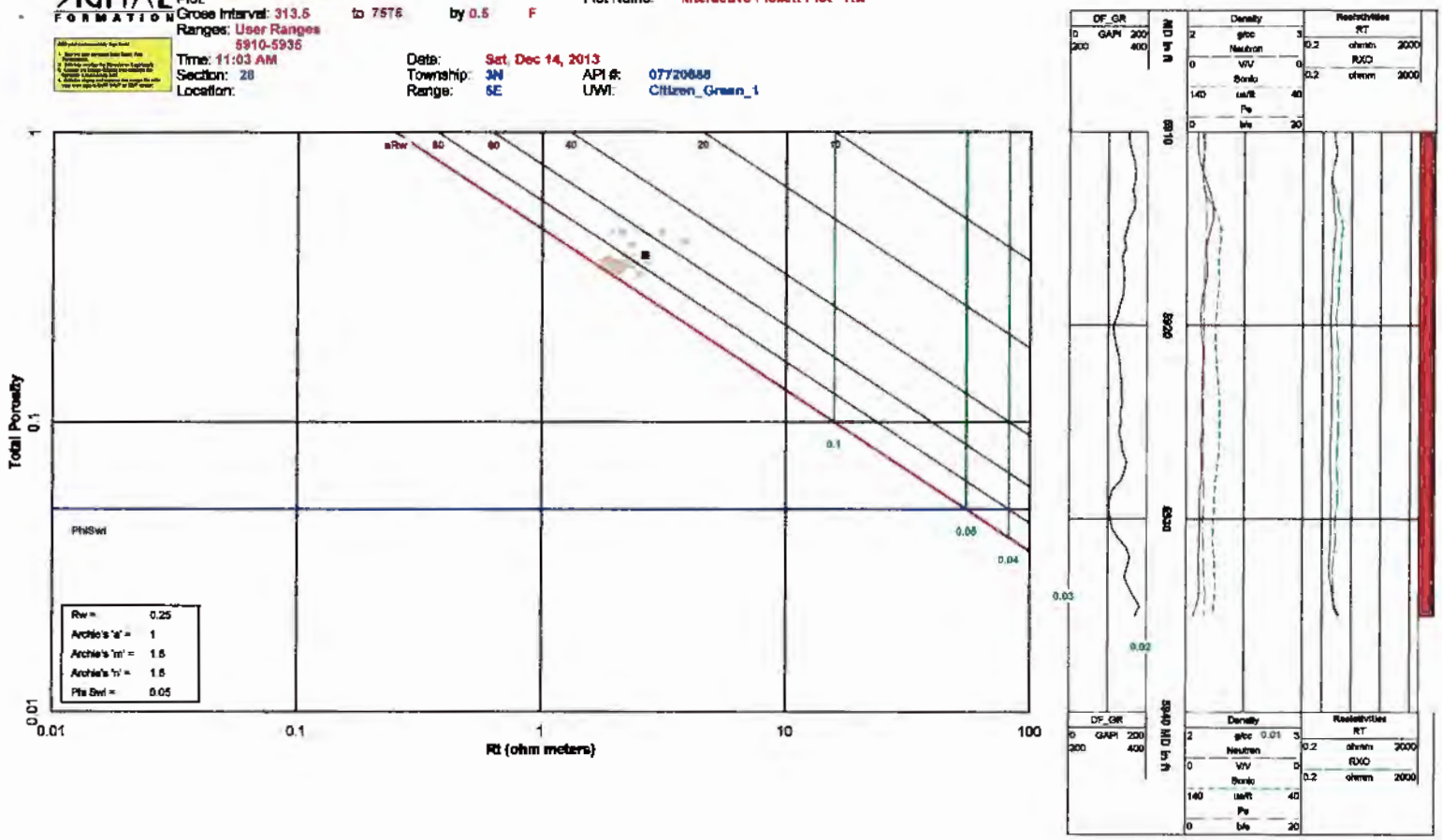
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5990-6080
Time: 09:48 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1





T: 137

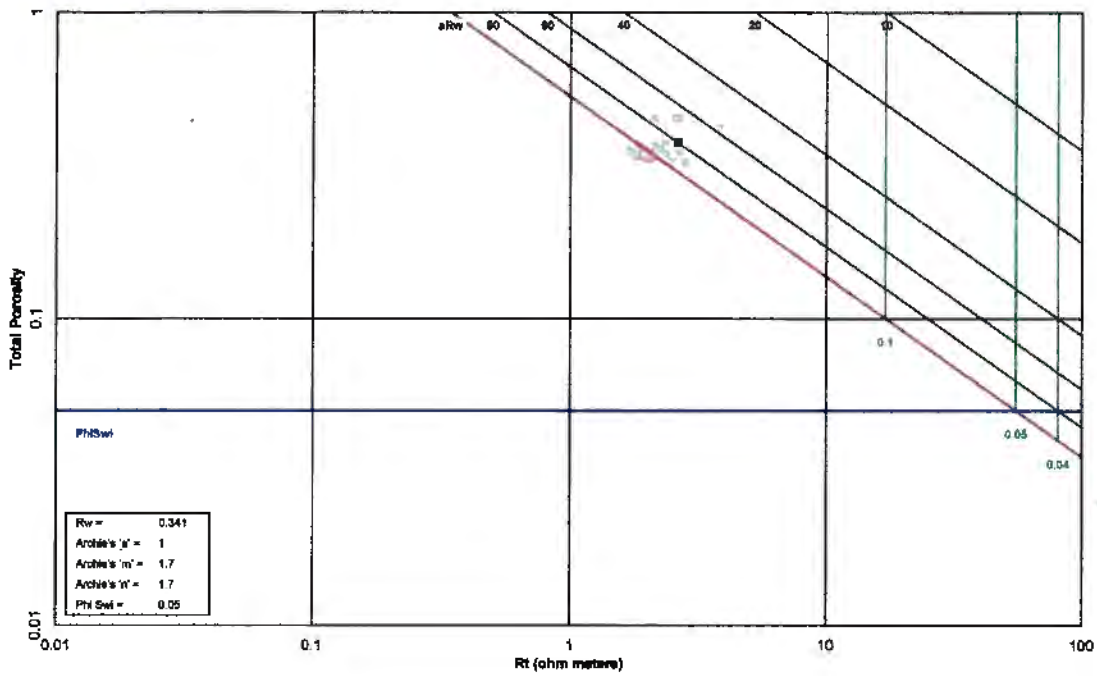
Rw 025 Salt 14000

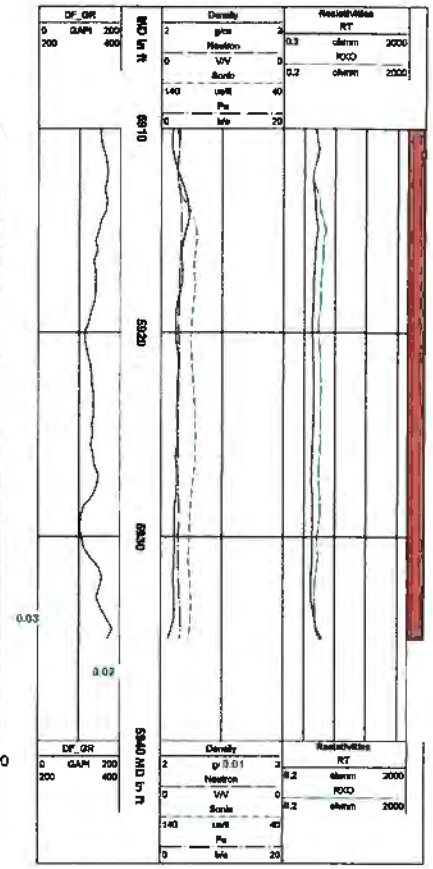
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5910-5935
Time: 09:47 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720668
UWI: Citizen_Green_1





T: 137

Rw: 0.341 Sat 9500

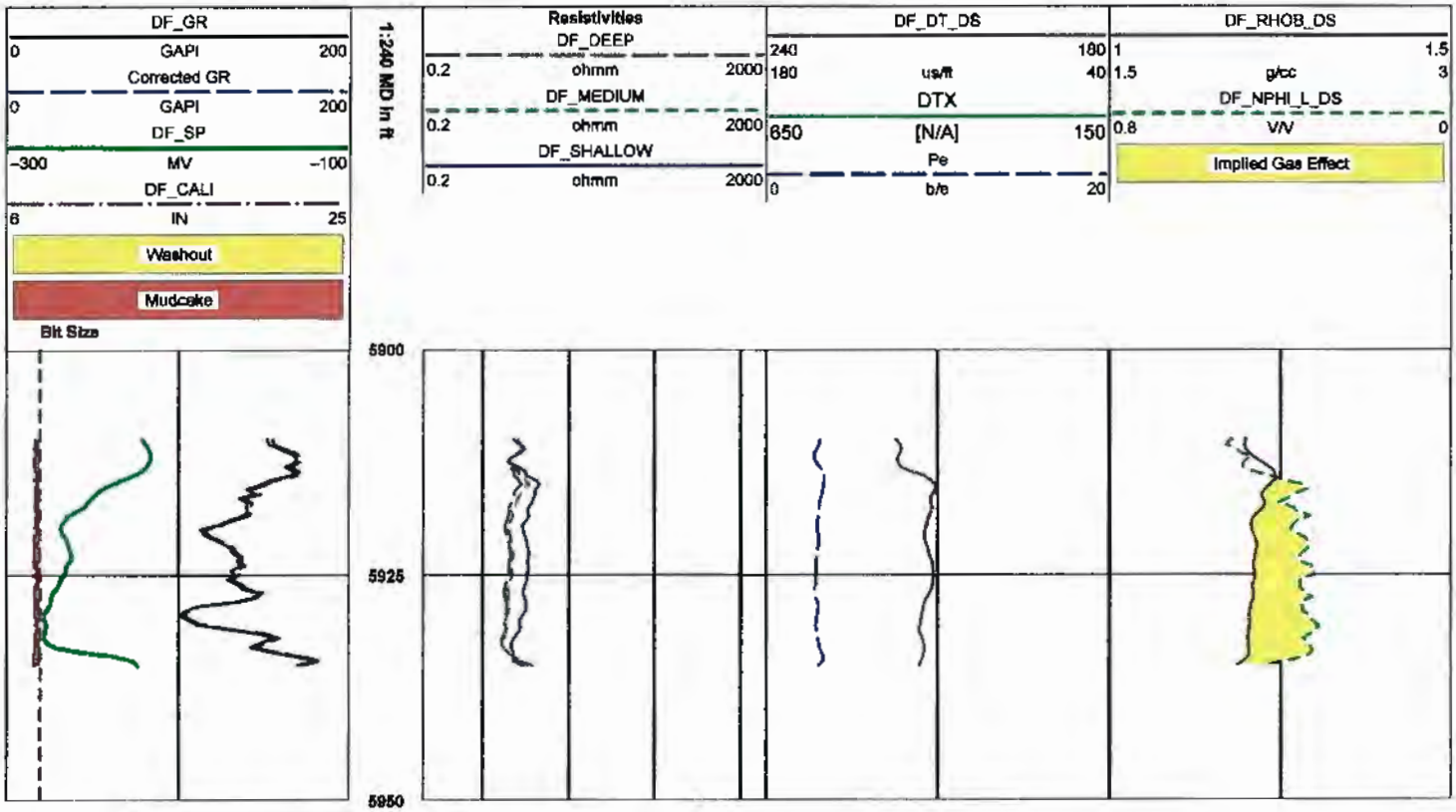
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5910-5935
Time: 09:47 AM
Section: 28
Location:

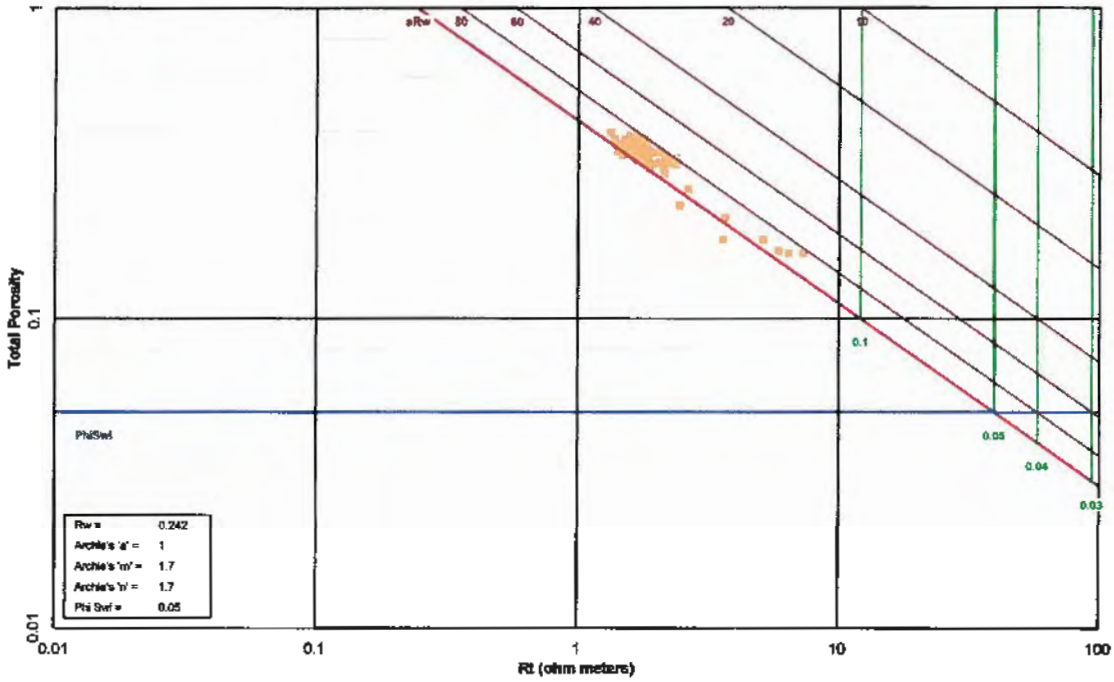
Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

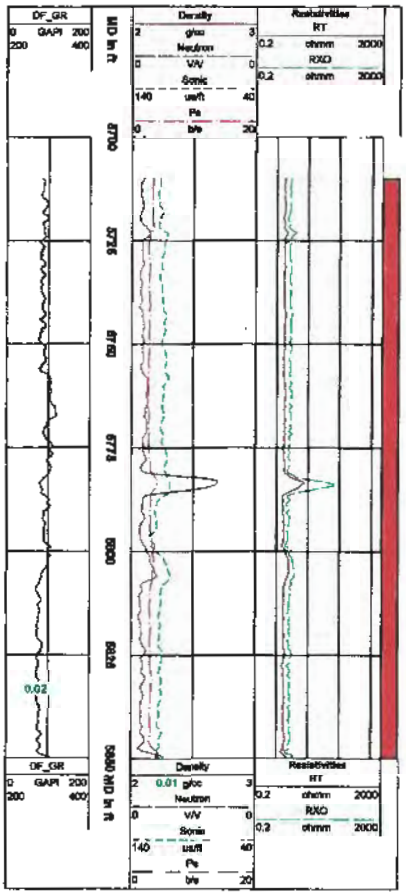
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



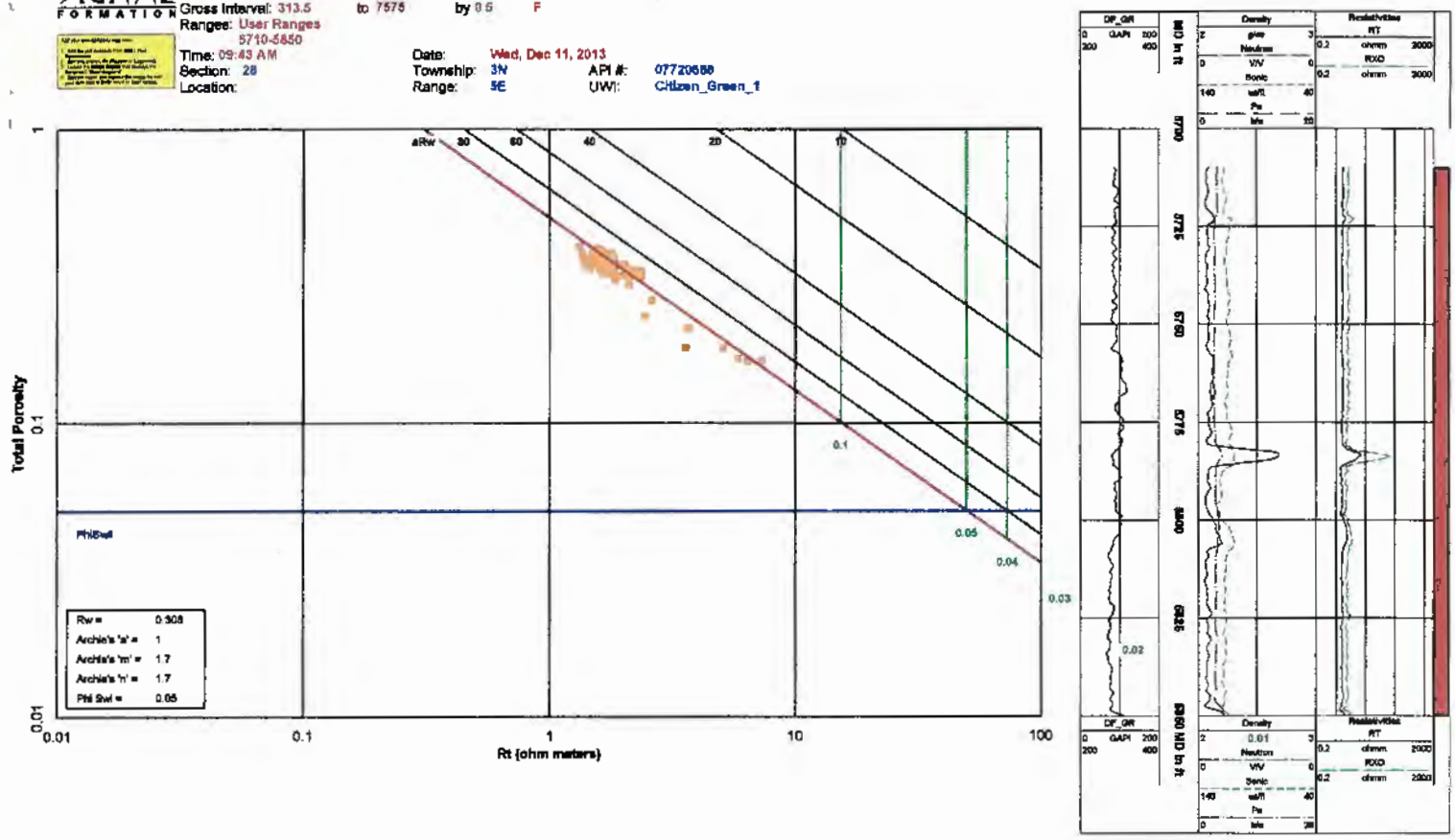
LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5710-5850
Time: 09:15 AM
Section: 28
Location:
Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E
Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw
API #: 07720688
UWI: Citizen_Green_1





T 13S

Rw 0.242 Salt 14000



T. 13S

Rw = 0.308 Salinity 10,500

DIGITAL FORMATION

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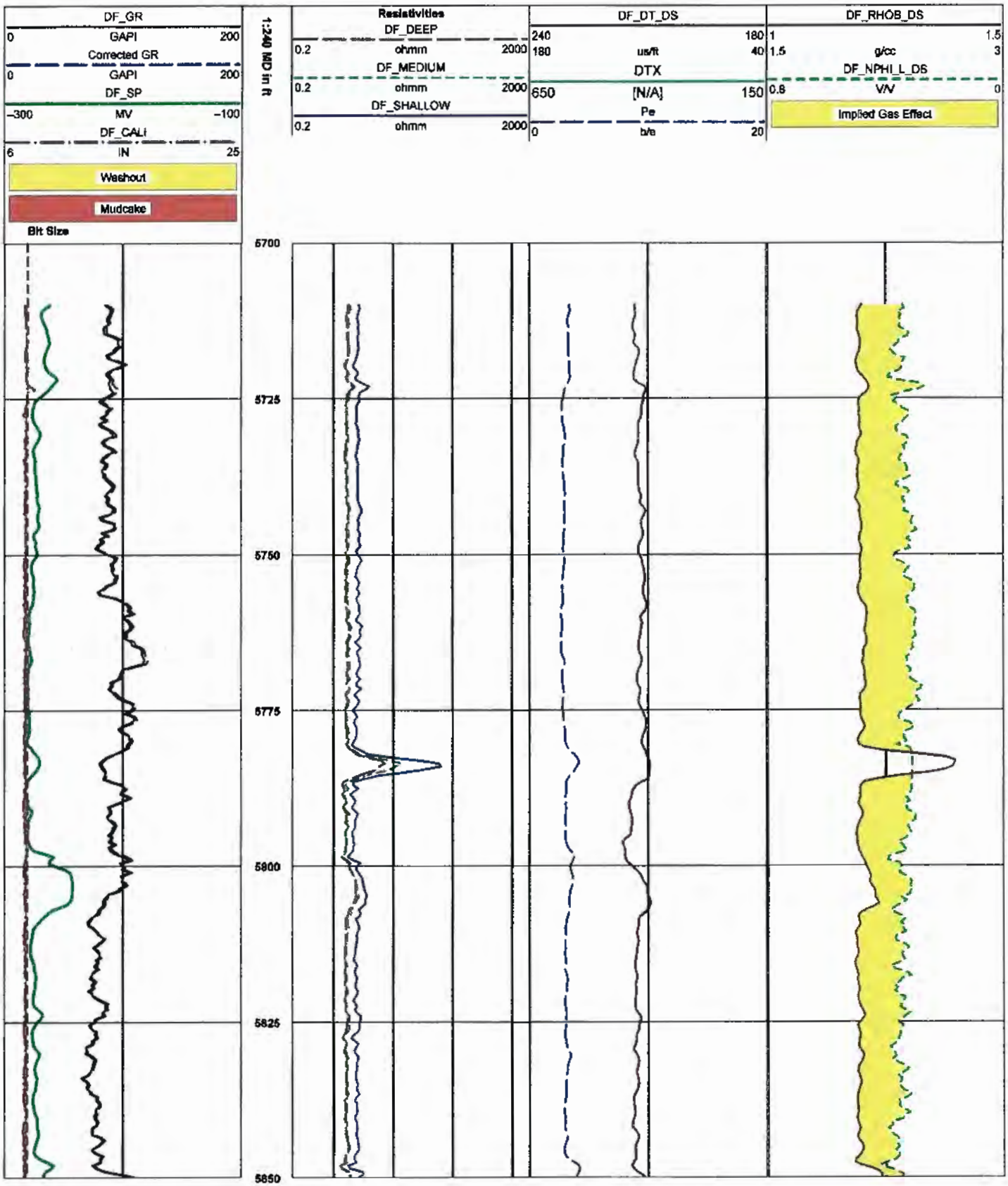
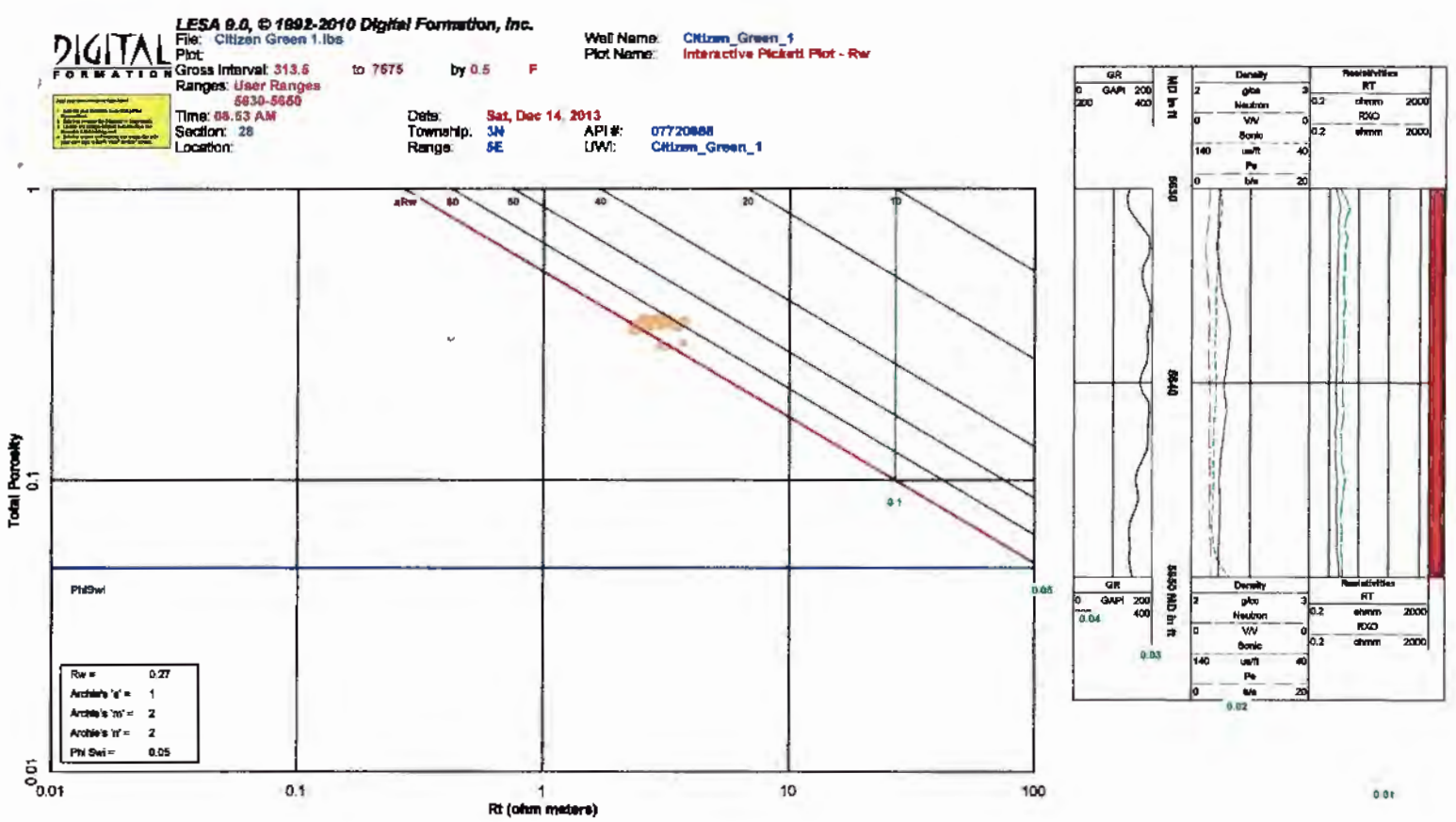
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5710-5850
Time: 09:42 AM
Date: Wed, Dec 11, 2013
Section: 28
Township: 3N
Range: 5E
Location:

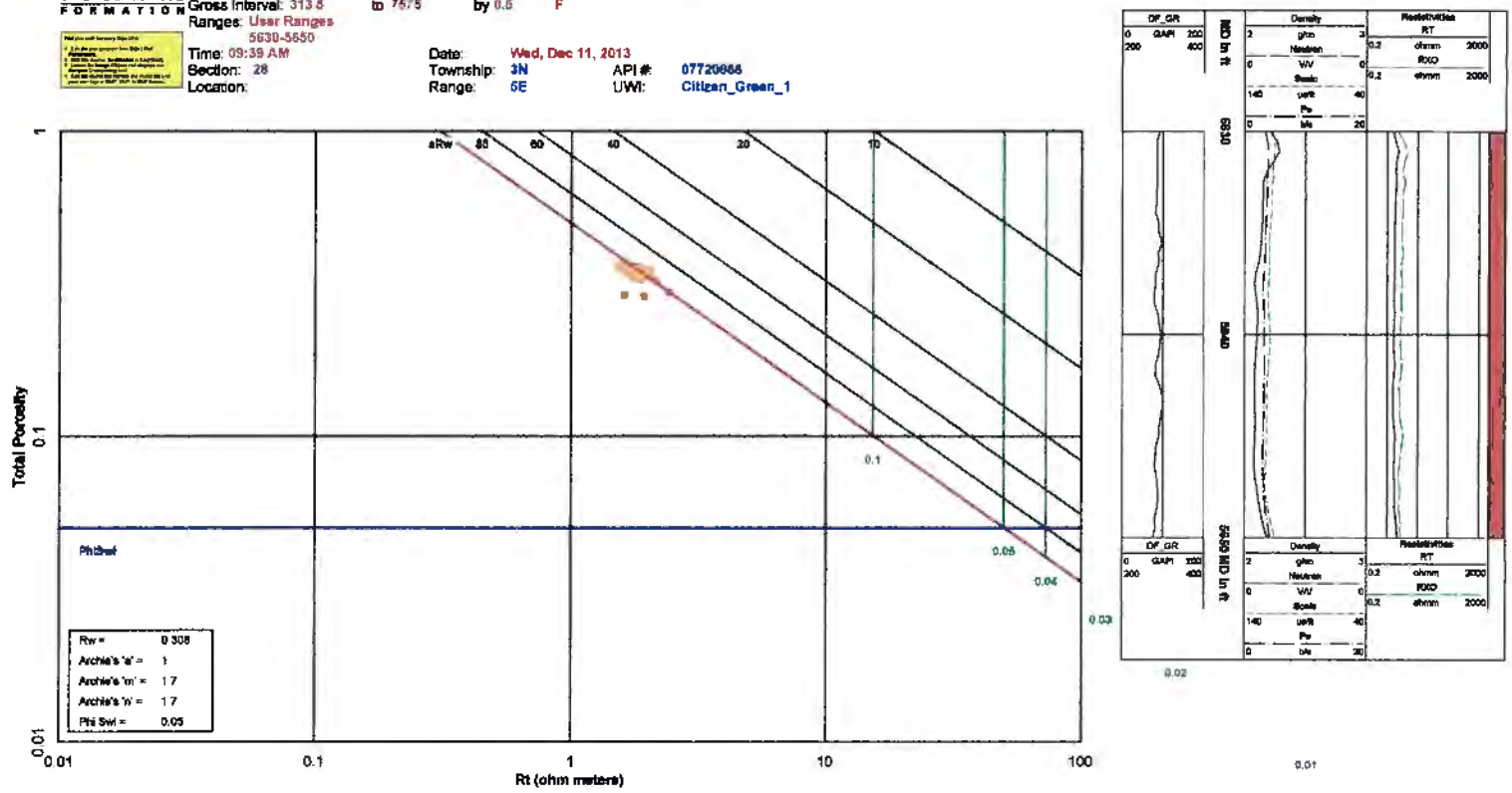
Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)
API #: 07720688
UWI: Citizen_Green_1





T 133

Rw 0.27 Salt 15000



T: 133

Rw: 0.308 Sal: 11,000

DIGITAL FORMATION

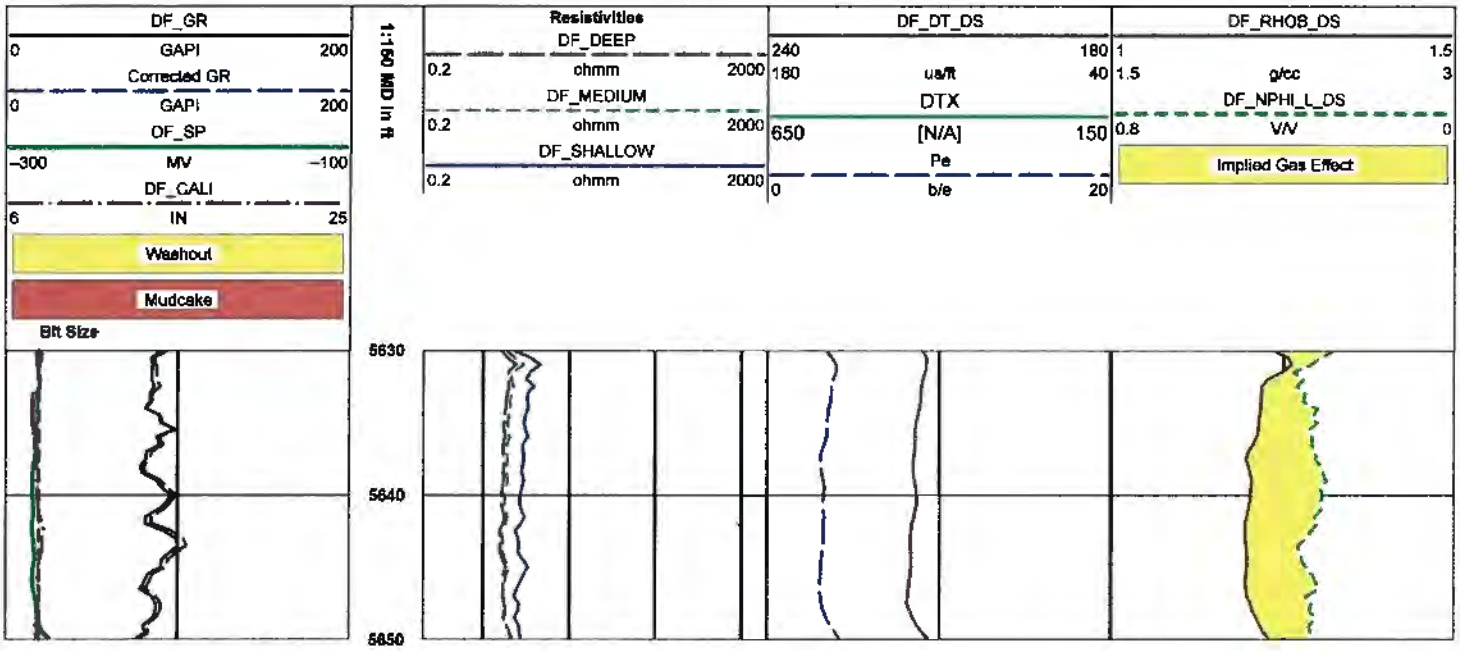
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5630-5650
Time: 09:39 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

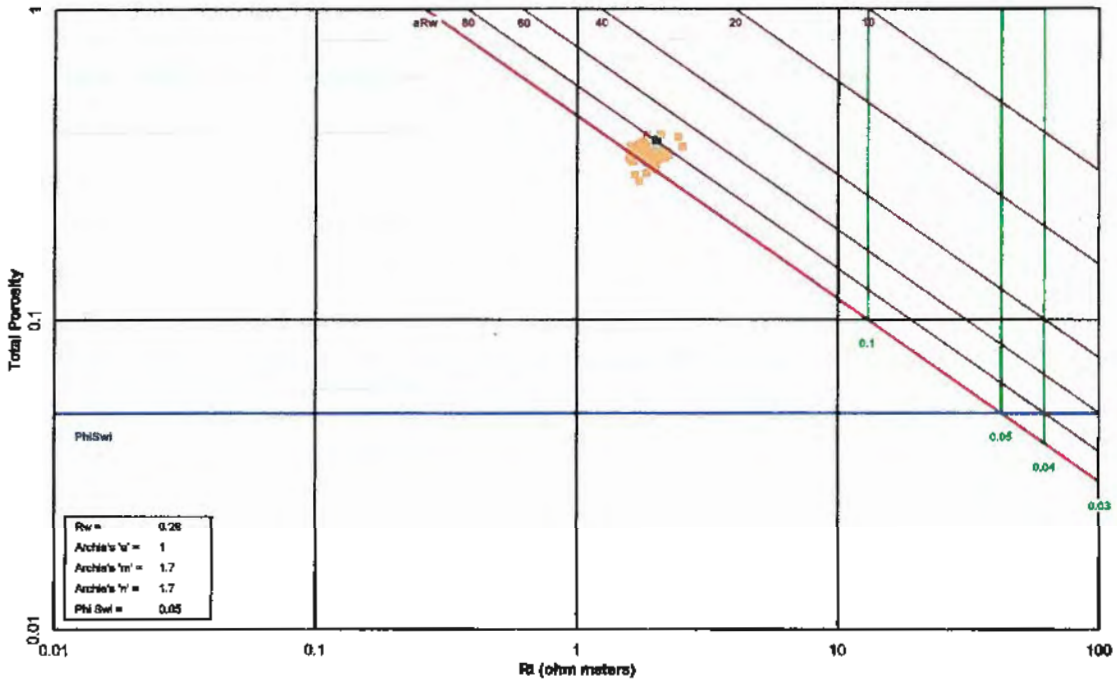


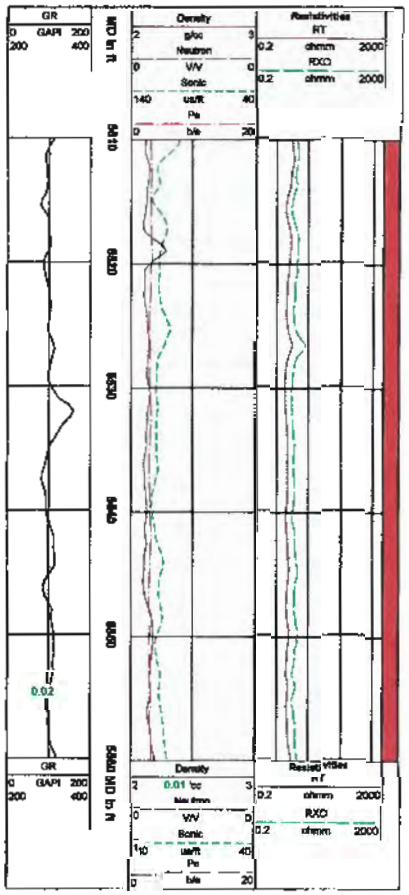
DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.6 to 7575 by 0.5 F
Ranges: User Ranges
5510-5660
Time: 08:50 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T 133

Rw 0.26 Salinity 14 000

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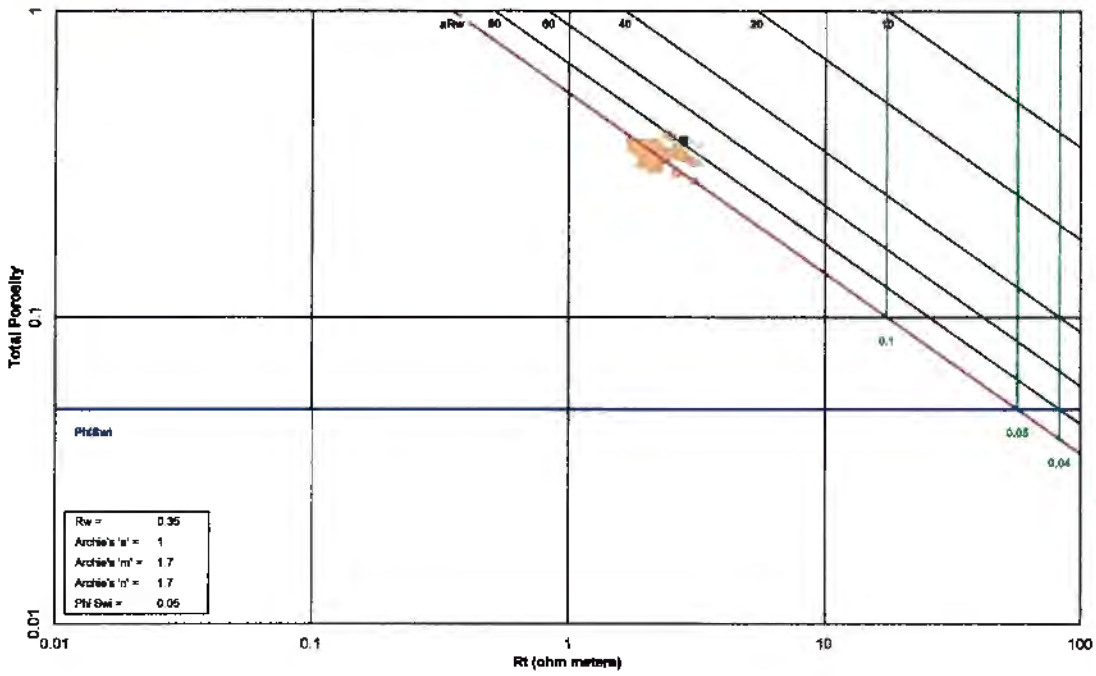
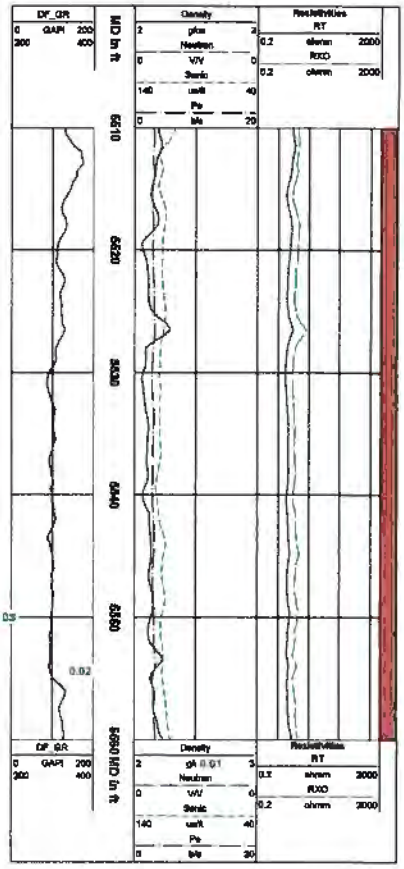
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5510-5560
Time: 09:37 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720686
UWI: Citizen_Green_1





T = 132

Rw = 0.35 Salinity 10,000

DIGITAL FORMATION

Add your own company logo here!
1. Edit the plot template from **Edit | Plot Parameters**.
2. Edit this overlay file (**Header** or **Log Head**).
3. Locate the **Image Object** that displays the filename C:\depth\log.bmp
4. Edit the object and replace the image file with your own logo in BMP, WMF or EMF format.

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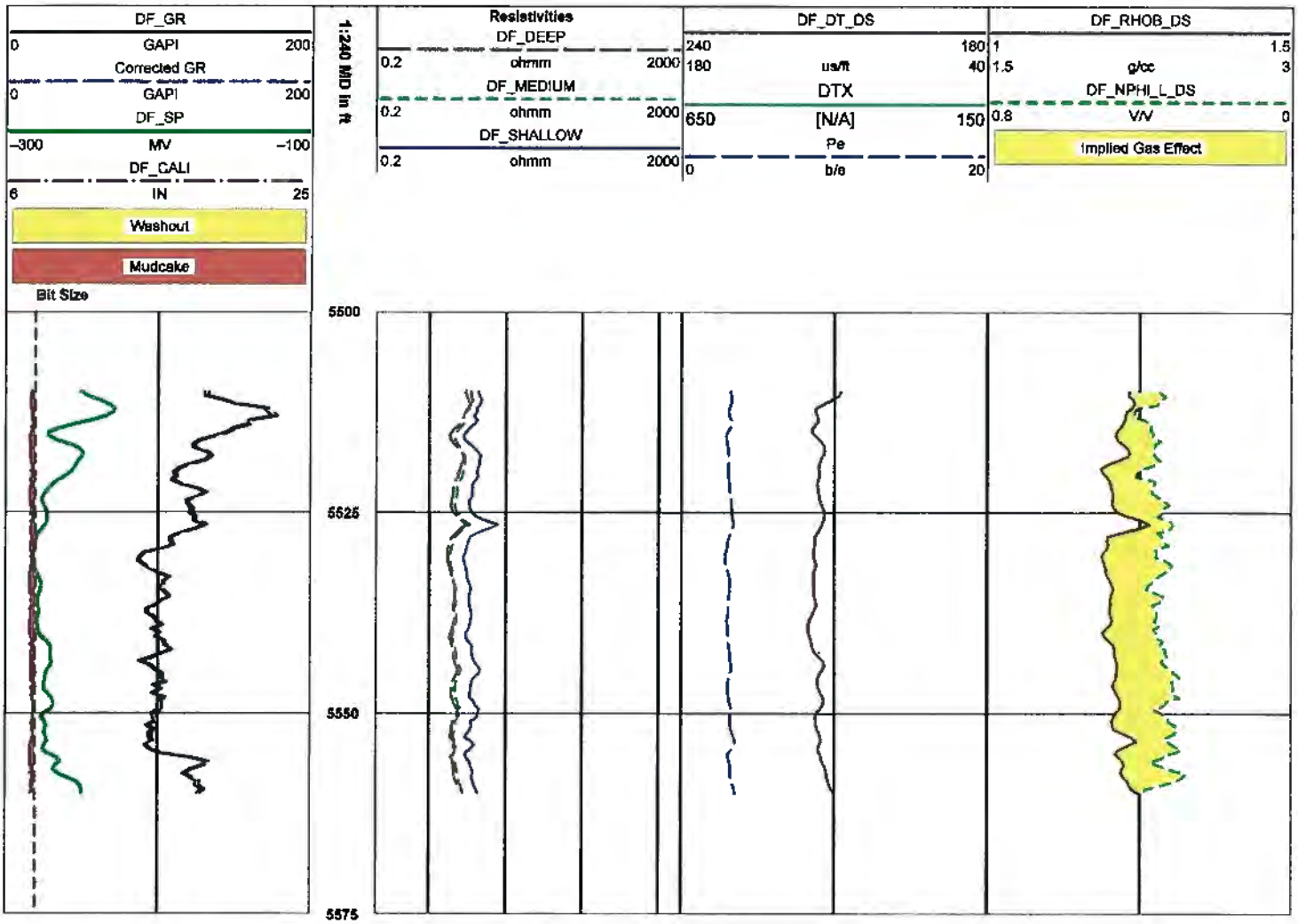
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5510-5560
Time: 09:36 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1

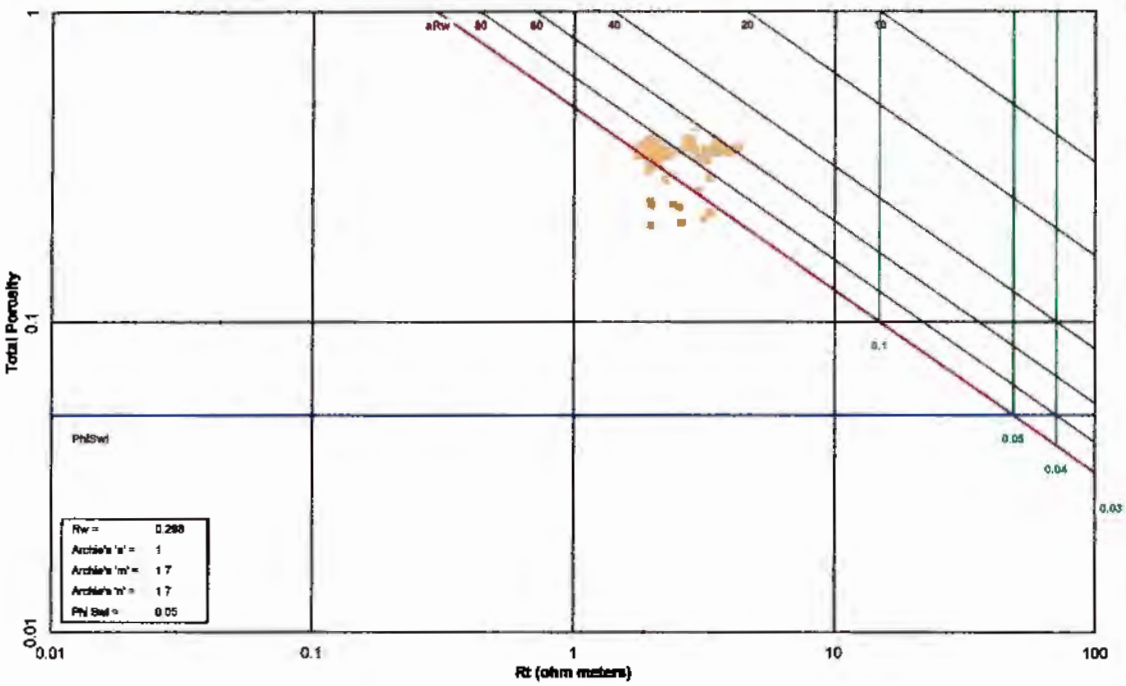


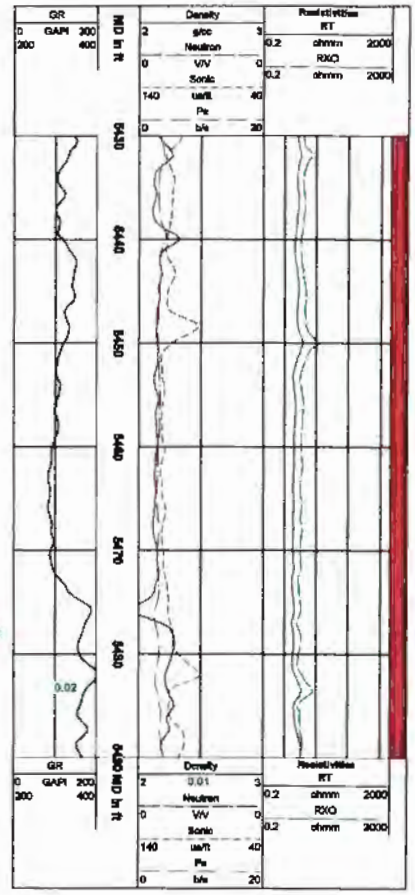
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.6 to 7575 by 0.5 F
Ranges: User Ranges
5430-5490
Time: 08:47 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T 131

Rw 0.298 Satisf. 11500

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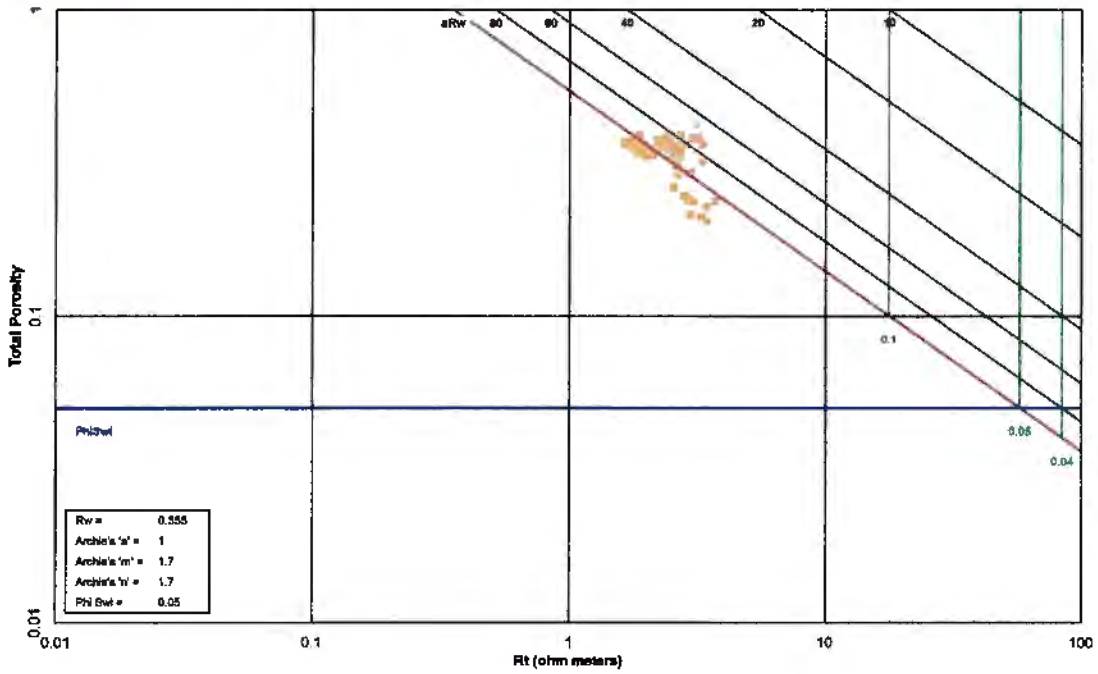
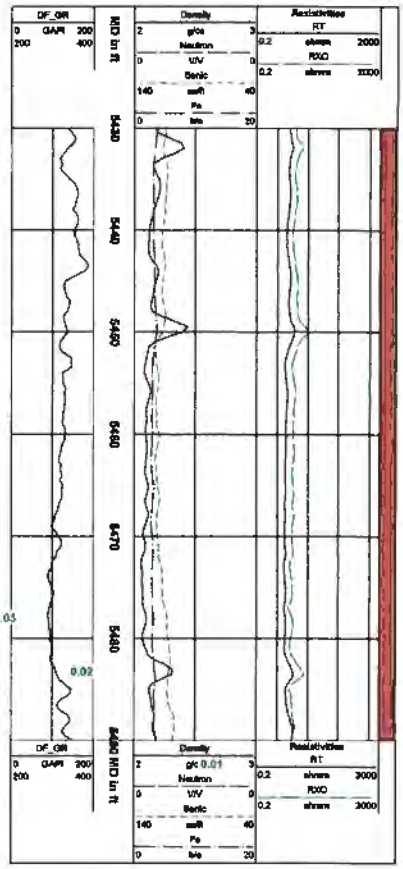
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5430-5490
Time: 09:03 AM
Section: 28
Location:

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720668
Range: 5E UWI: Citizen_Green_1

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw





T = 131

$R_w = 0,355$ Salinity 10,000

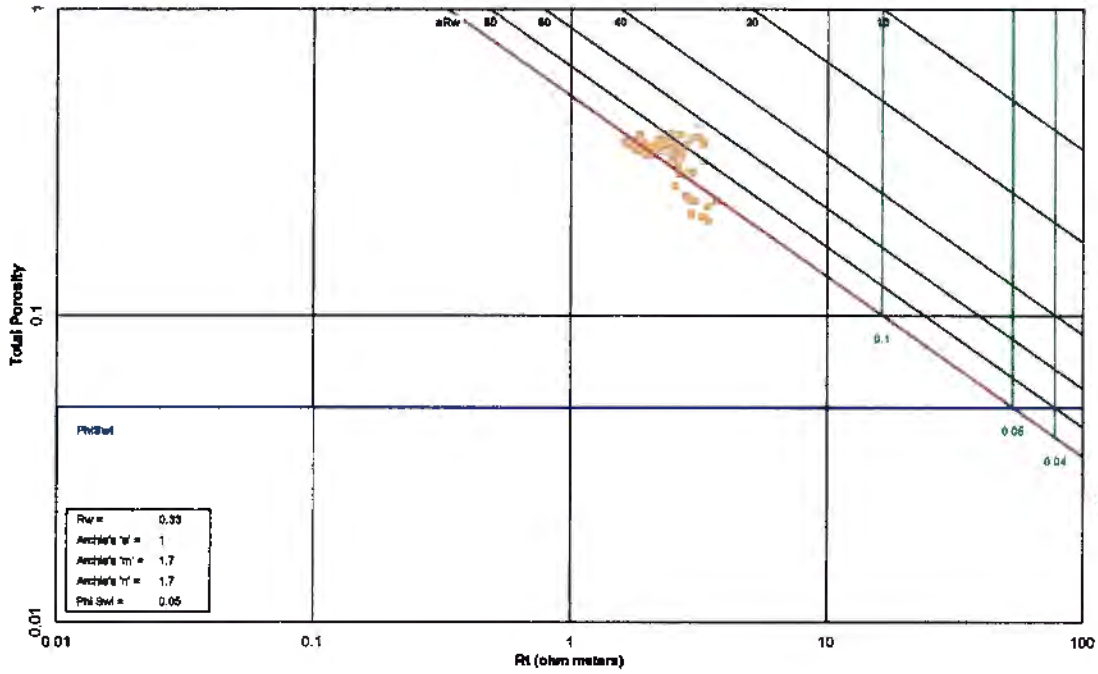
LESA 9.0, © 1992-2010 Digital Formation, Inc.

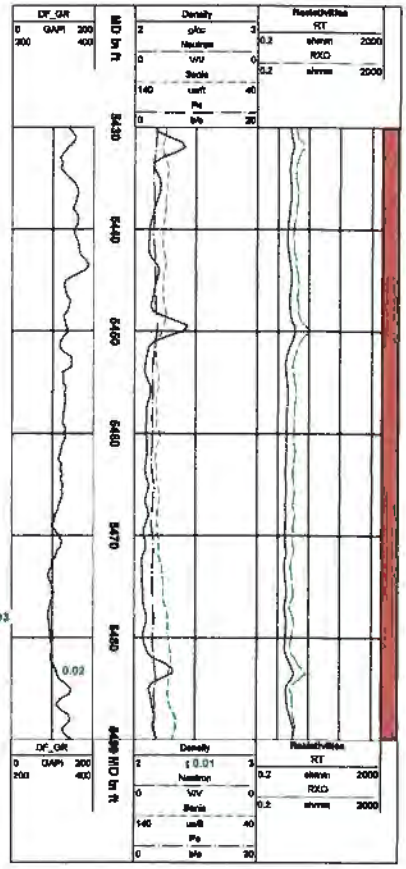
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5430-5490
Time: 04:53 PM
Section: 26
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





To 133

Rw: 0.33 Salty 10,500

DIGITAL FORMATION

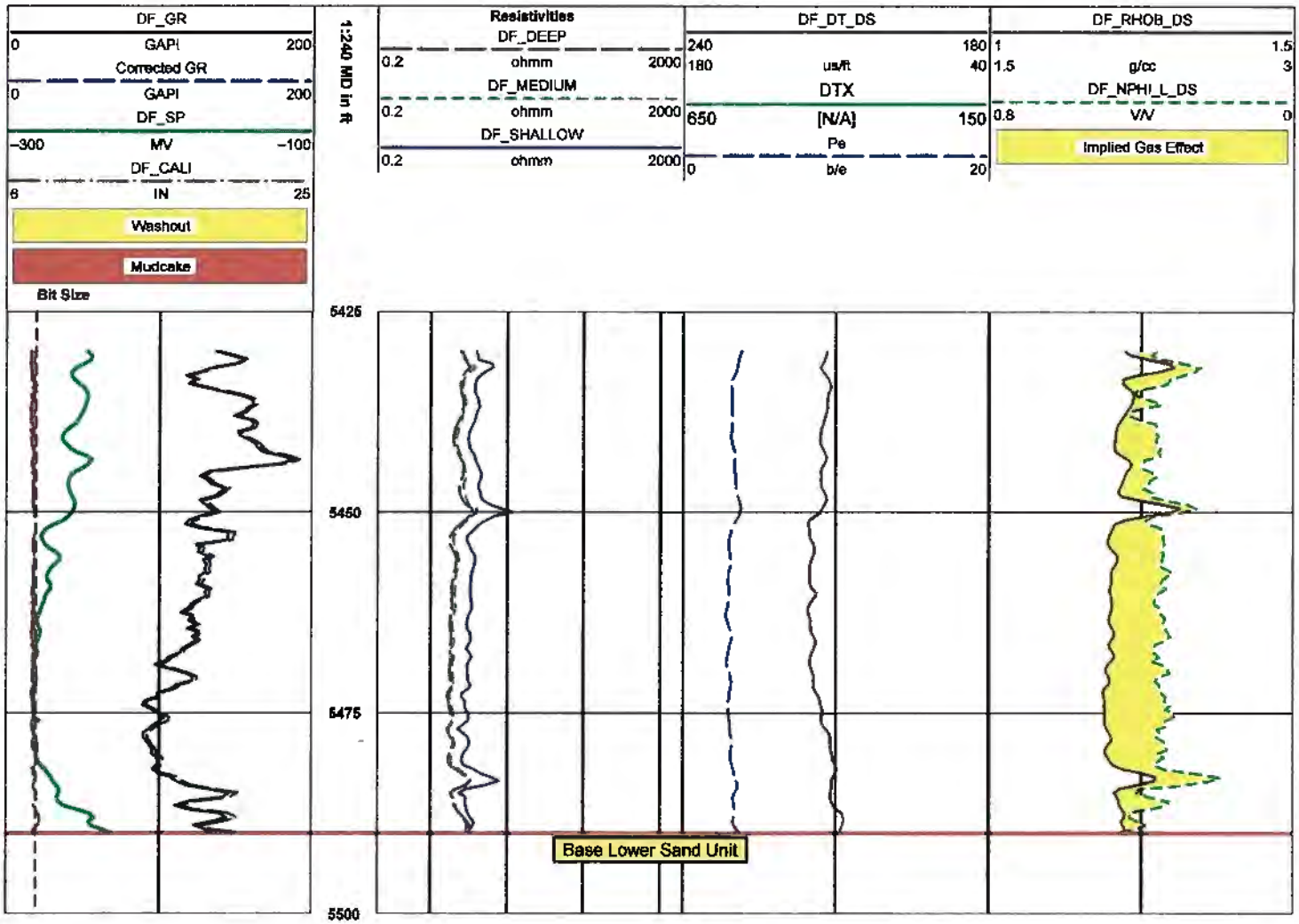
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5430-5490
Time: 04:54 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



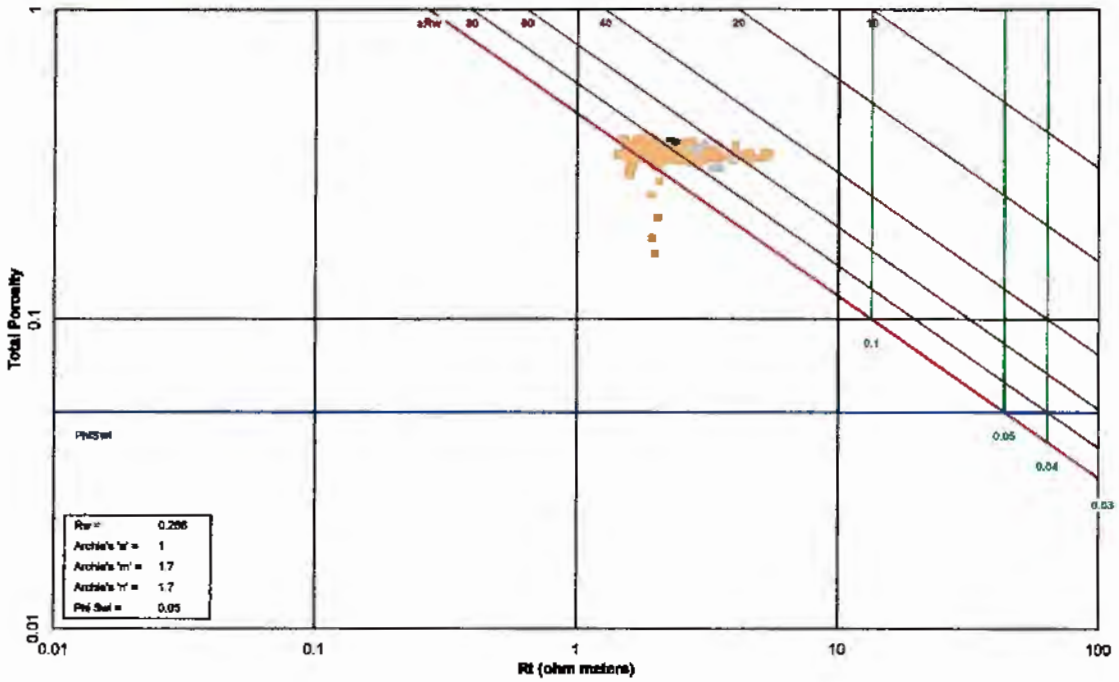
LESA 8.0, © 1992-2010 Digital Formation, Inc.

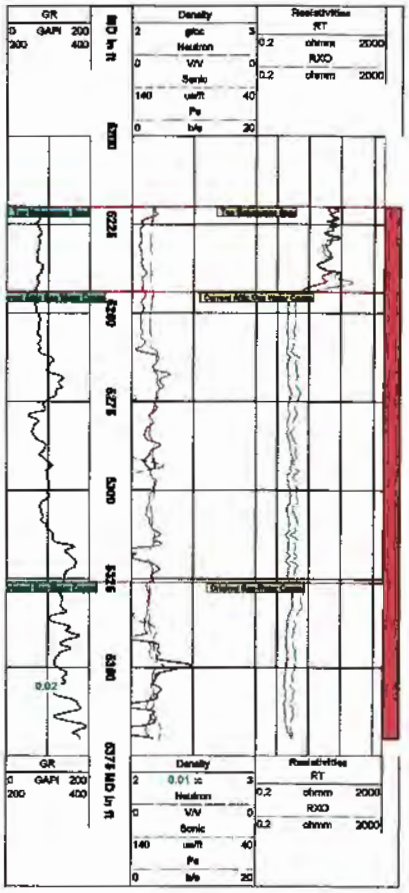
File: Citizen Green 1.fbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6220-6370
Time: 08:43 AM
Section: 28
Location:

Date: Sat, Dec 14, 2013
Township: 3N
Range: 6E

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

API #: 07720668
UWI: Citizen_Green_1





T 129

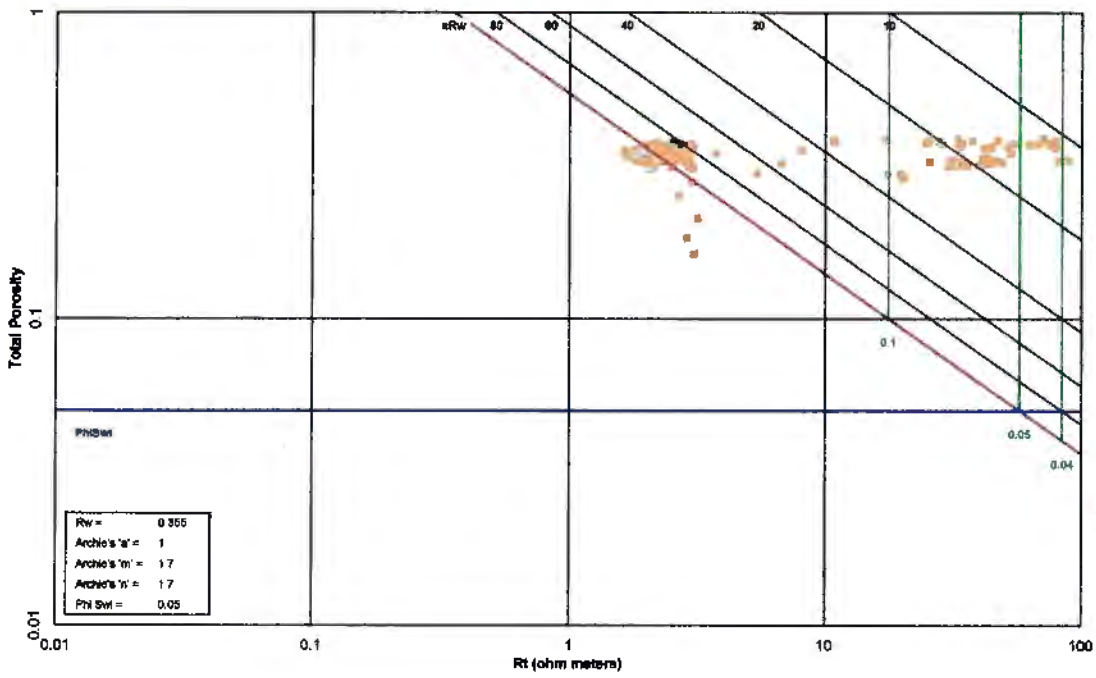
Rw = 0.268 Salinity 14000

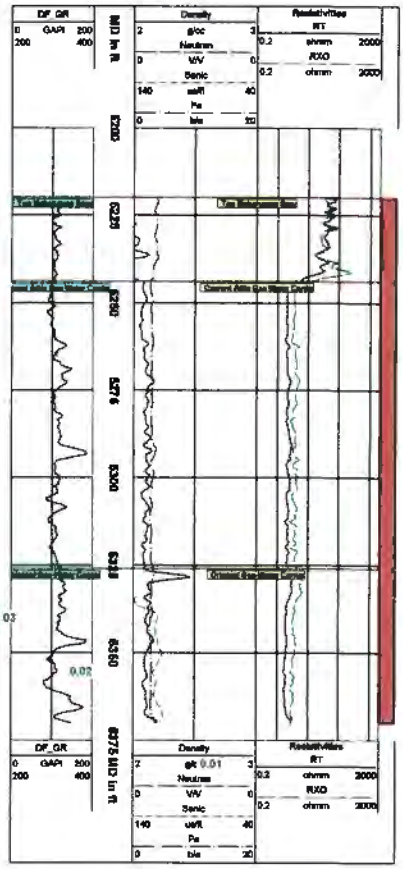
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5220-5370
Time: 09:01 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed. Dec 11 2013
Township: 3N
Range: 5E
API #: 07720655
UWI: Citizen_Green_1

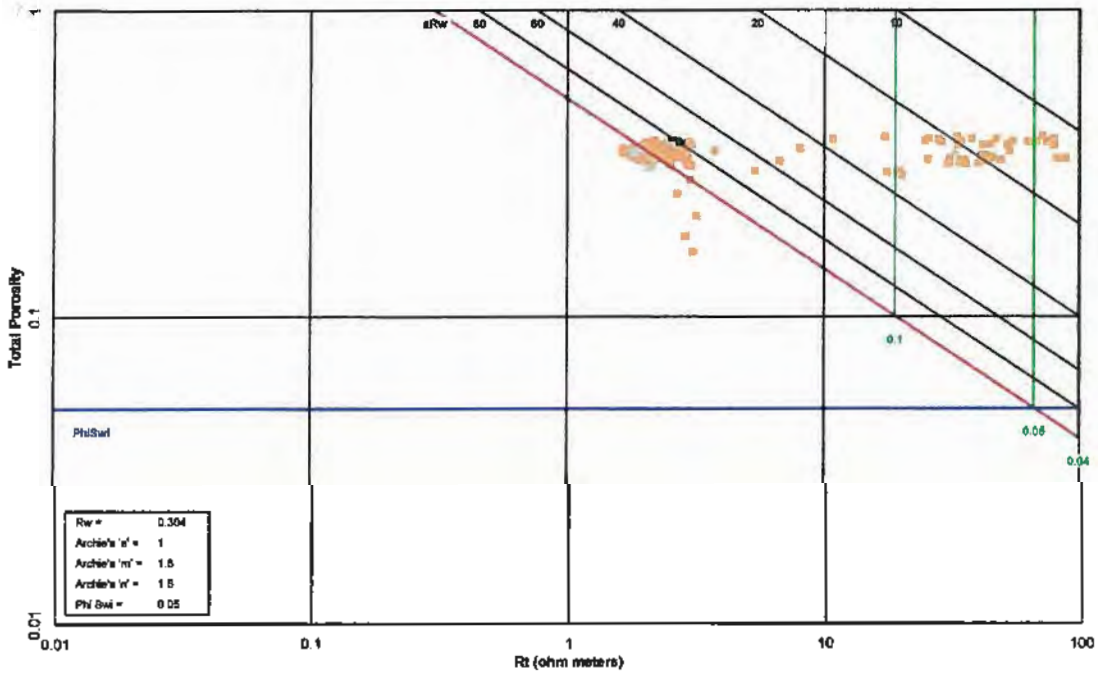


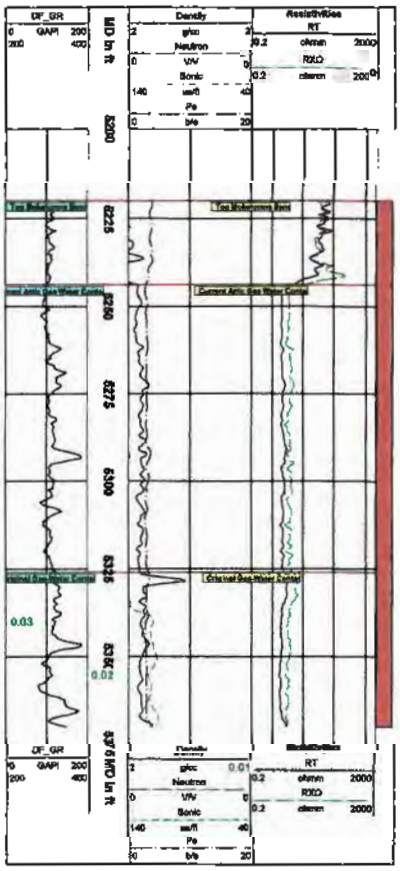


T: 129

Rw: 0.355 Salif 10000

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
6220-6370
Time: 04:50 PM
Section: 28
Location:
Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw
API #: 07720686
UWI: Citizen_Green_1





T_f 130°

R_w 0.304 Salinity 11,000

DIGITAL FORMATION

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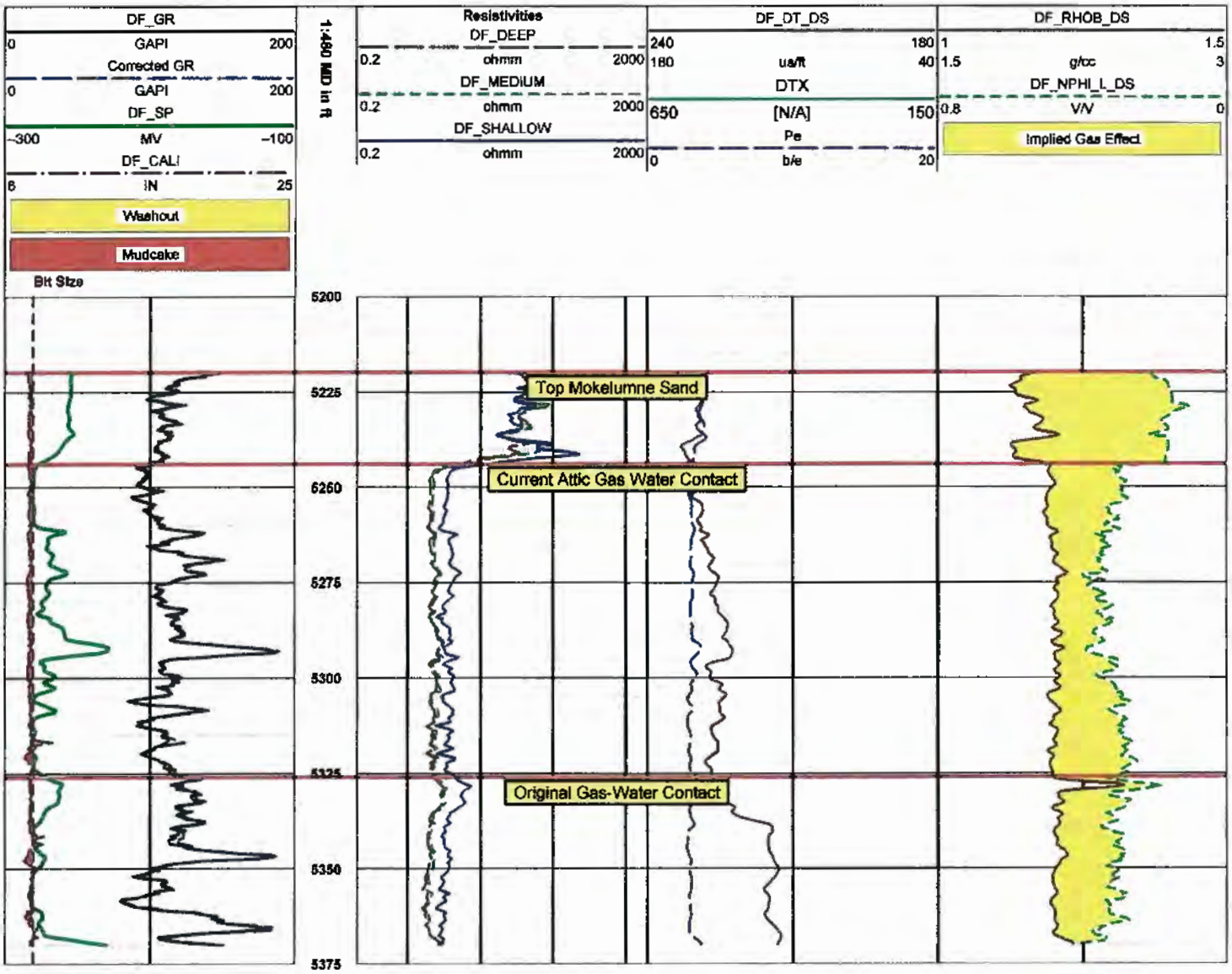
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5220-5370
Time: 04:49 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

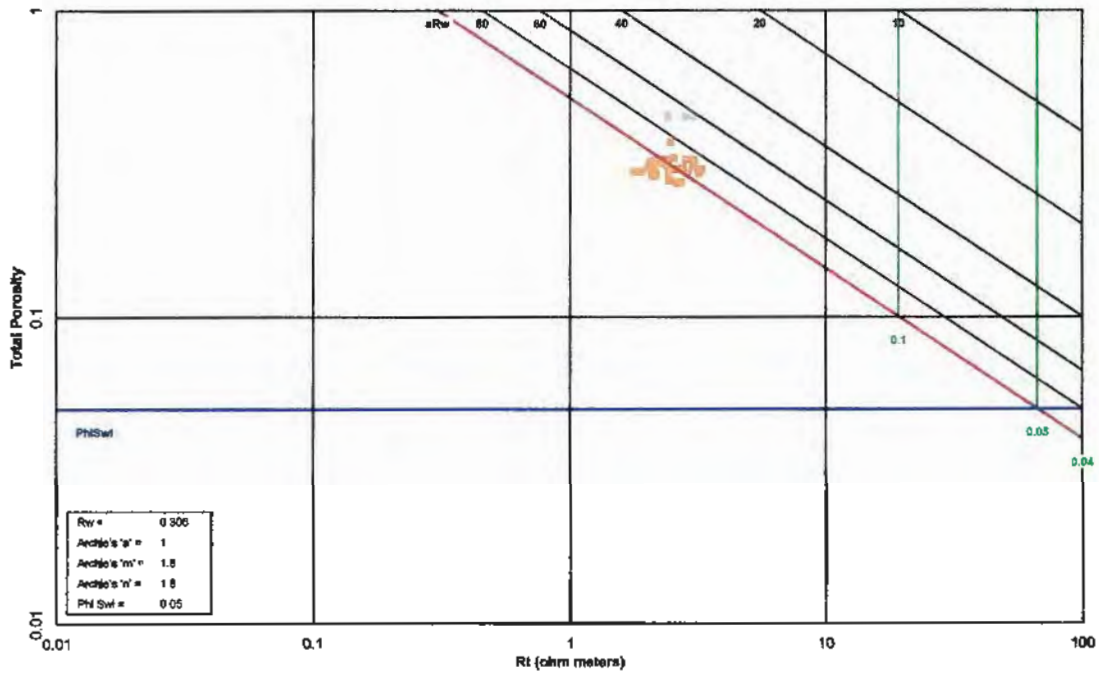


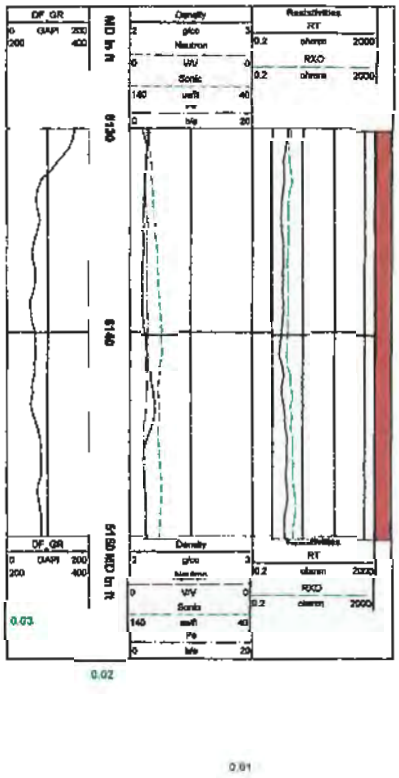
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5130-5150
Time: 08:59 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720688
Range: 5E UWI: Citizen_Green_1





T = 126

Rw = 0.028 Salty 11000

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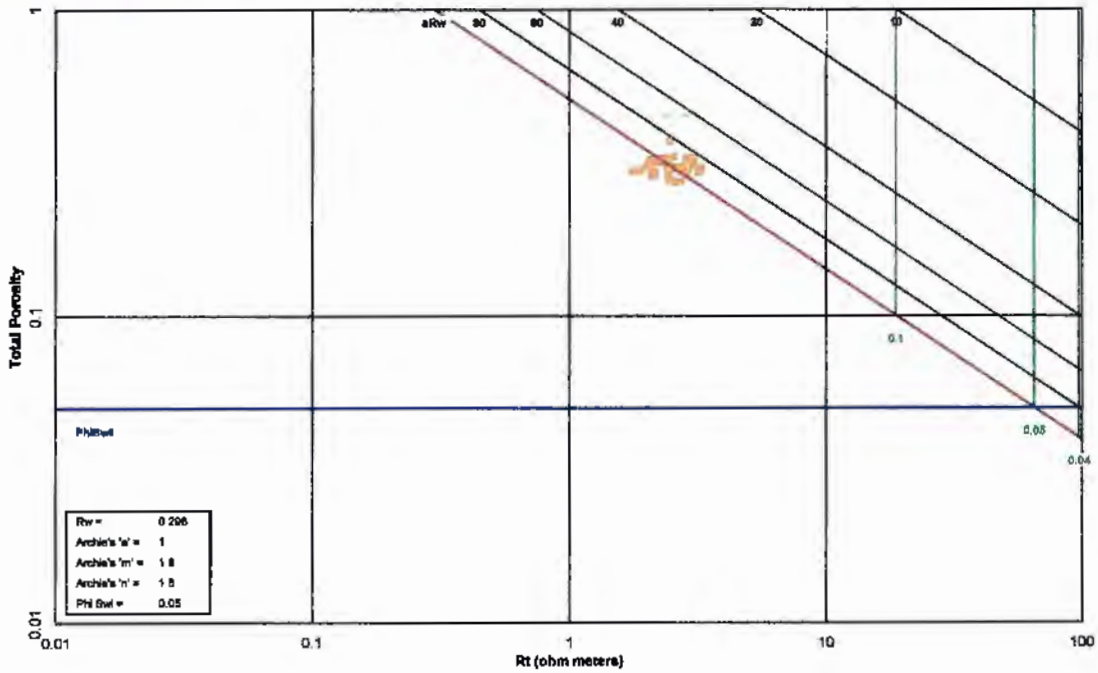
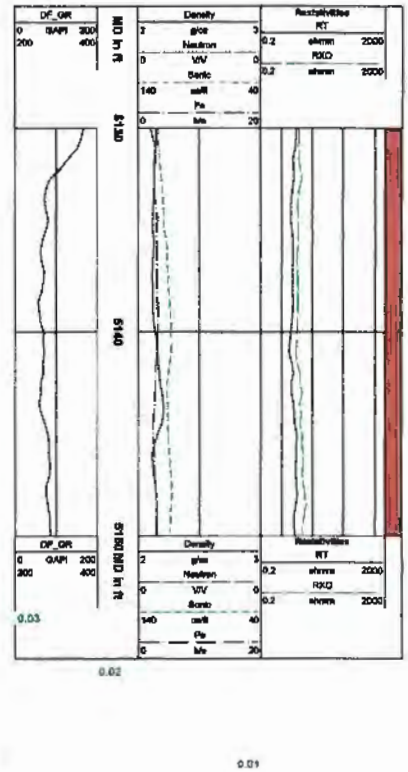
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5130-5150
Time: 04:46 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue Dec 10 2013
Township: 3N
Range: 5E
API #: 07720668
UWI: Citizen_Green_1





T = 122

Rw = 0.298 Salinity

DIGITAL FORMATION

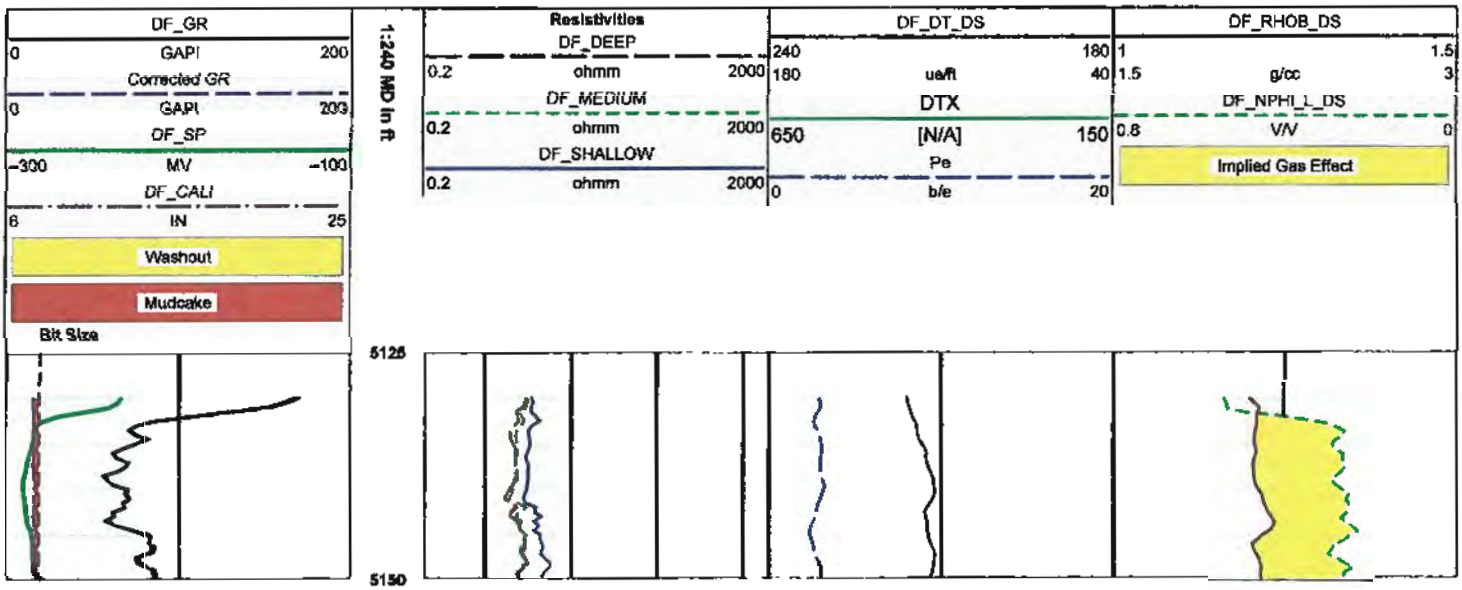
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
5130-5150
Time: 04:47 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

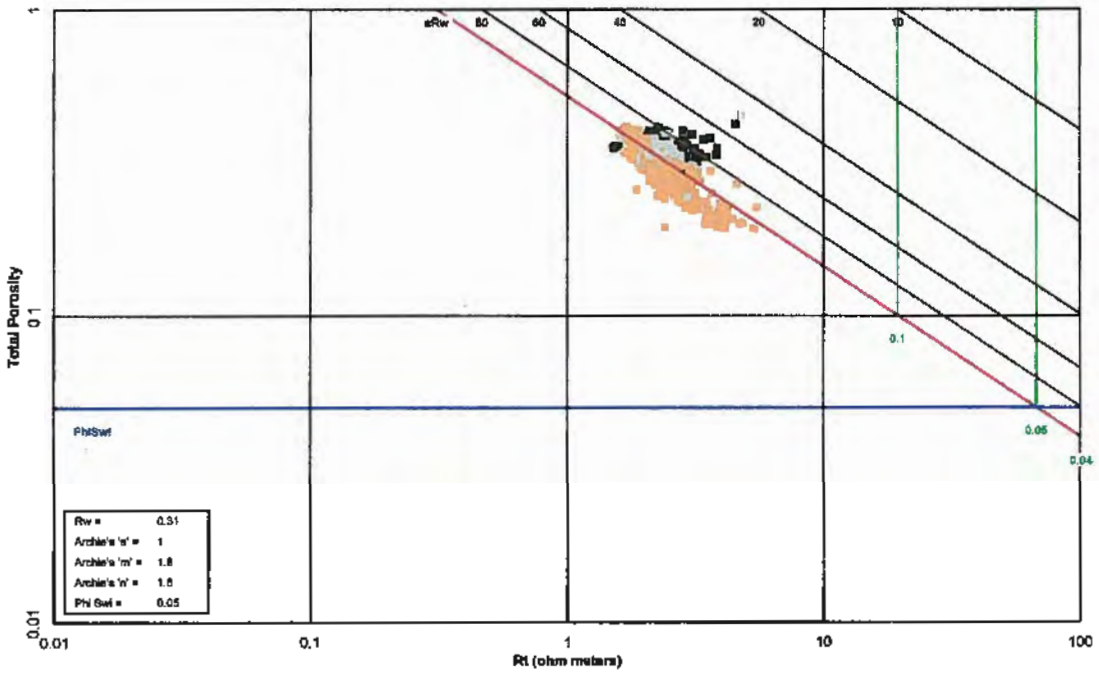


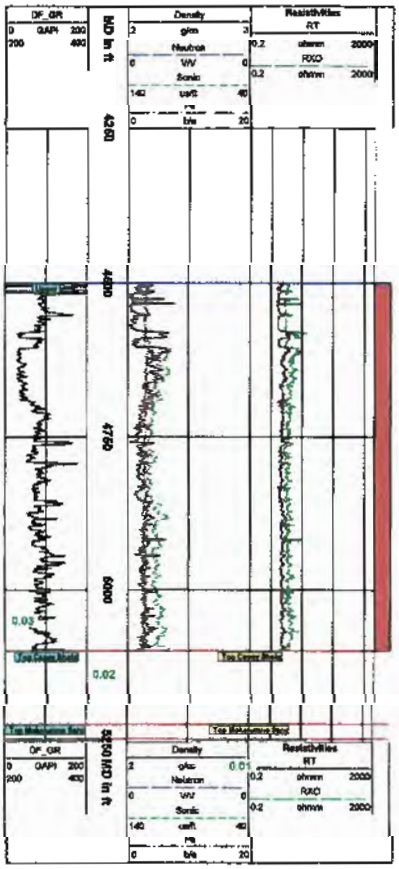
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
4500-5100
Time: 08:57 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N API #: 07720688
Range: 6E UWI: Citizen_Green_1





T = 126

$R_w = 0.31$ Salinity 11000

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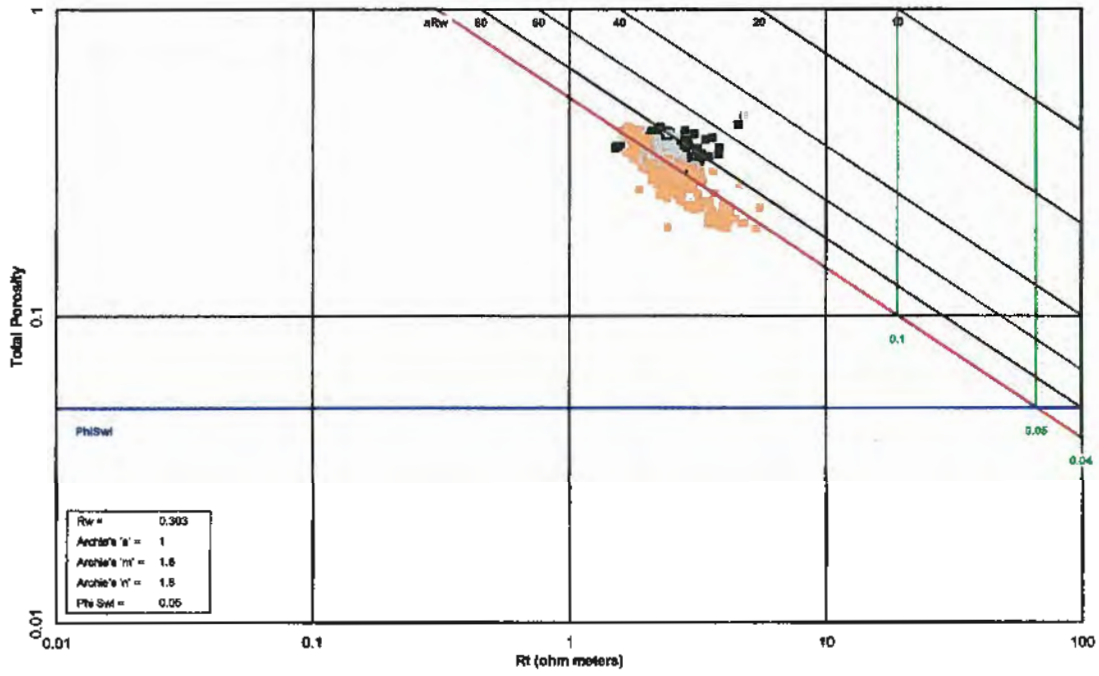
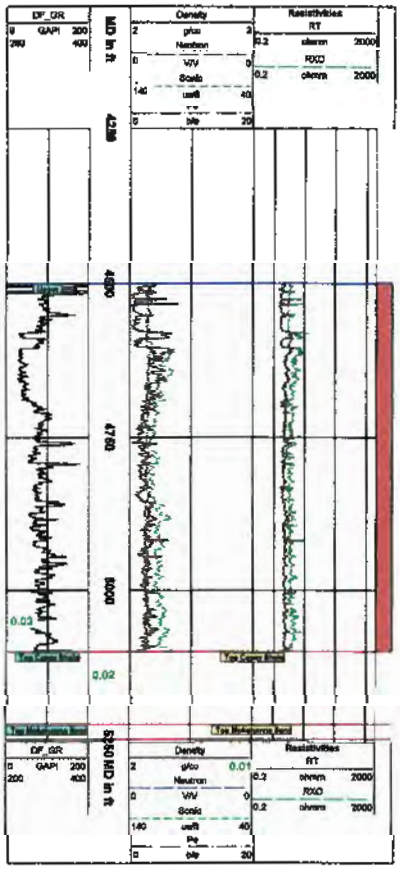
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
4500-5100
Time: 04:43 PM
Section: 28
Location:

Date: Tue, Dec 10, 2013
Township: 3N API #: 07720686
Range: 5E UWI: Citizen_Green_1

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw





Tx 117

R_w = 0.303 Salinity 12000

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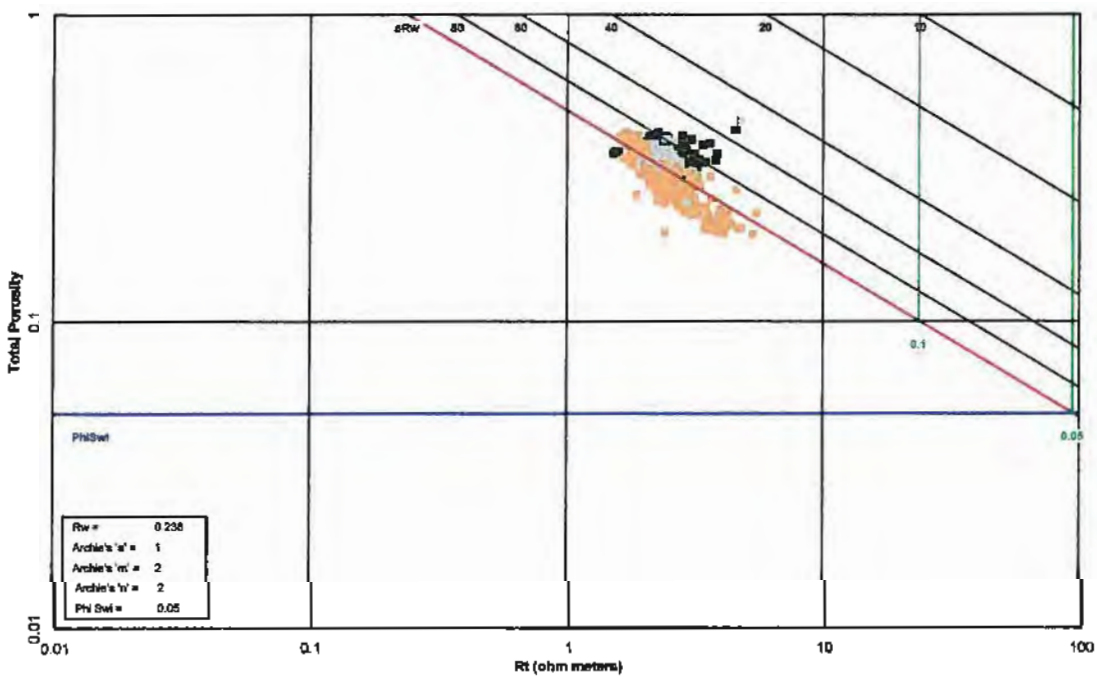
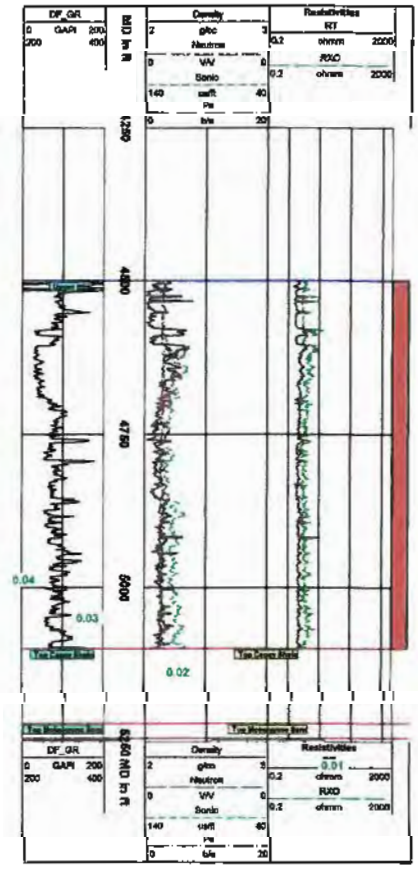
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges 4500-5100
Time: 04:37 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T: 117°

Rw: 0.238 Saling 18000

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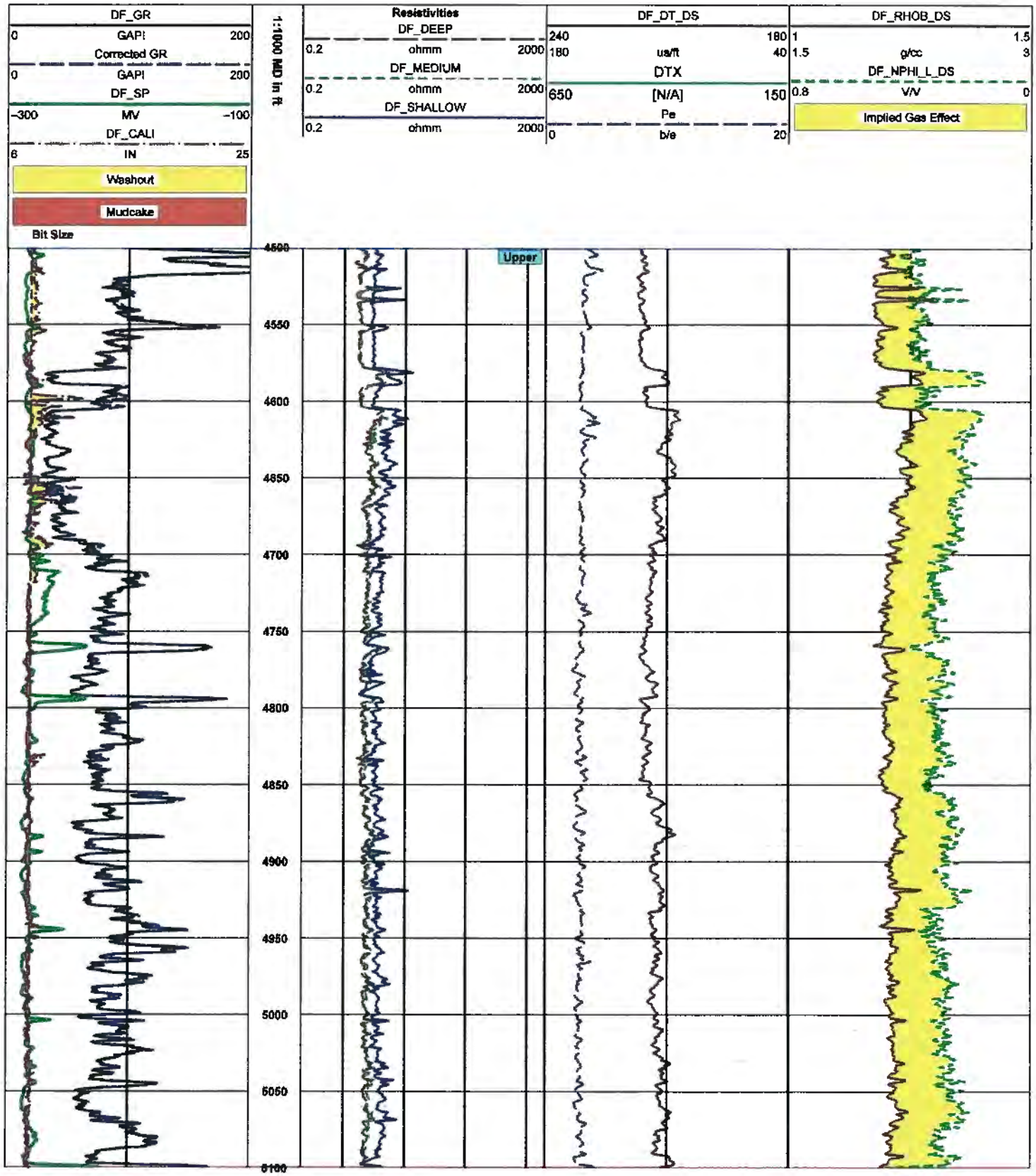
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
4500-5100
Time: 04:37 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



LESA 9.0, © 1992-2010 Digital Formation, Inc.

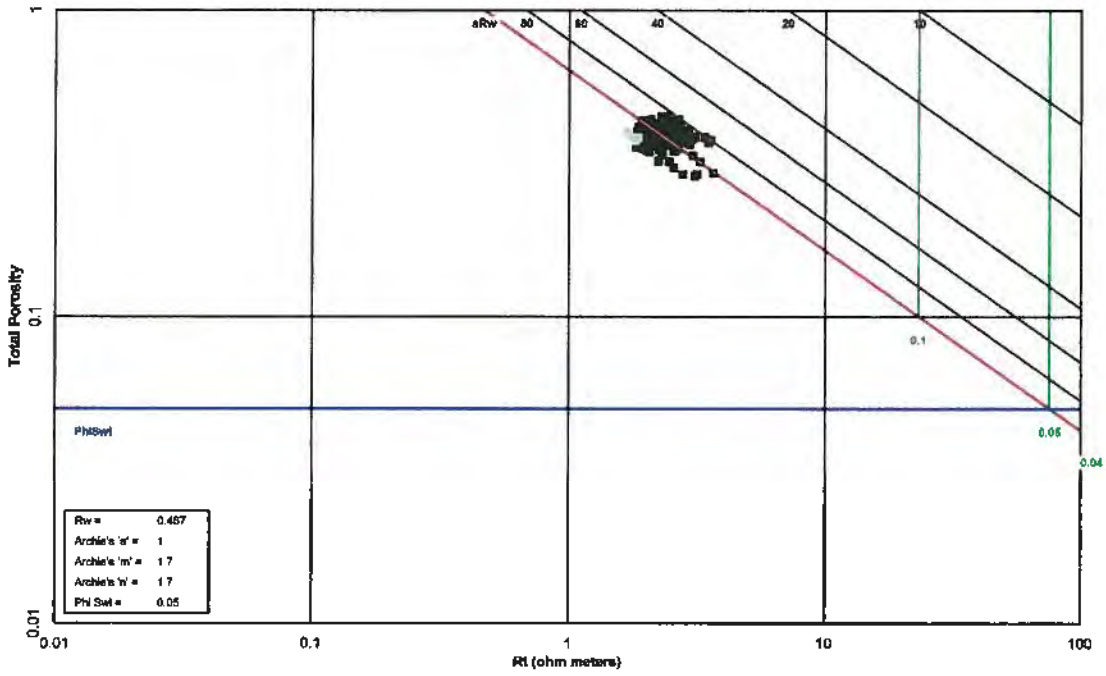
DIGITAL FORMATION

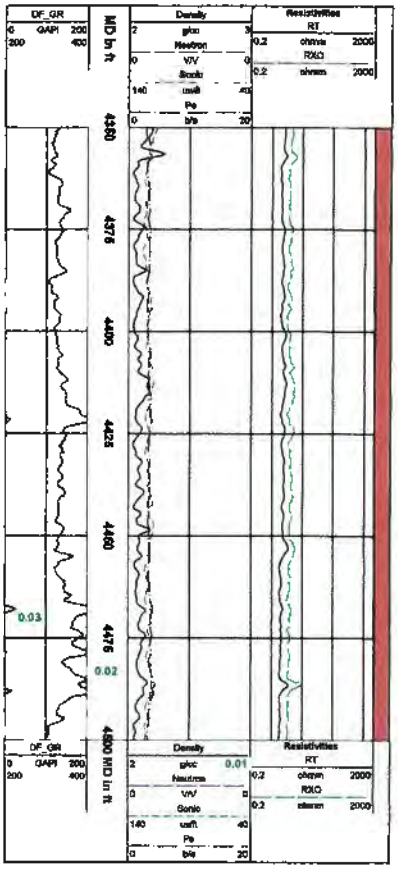
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
4350-4500
Time: 08:53 AM
Section: 28
Location:

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

API #: 07720688
UWI: Citizen_Green_1





T= 118

Rw= 0.467 Salw 90 00

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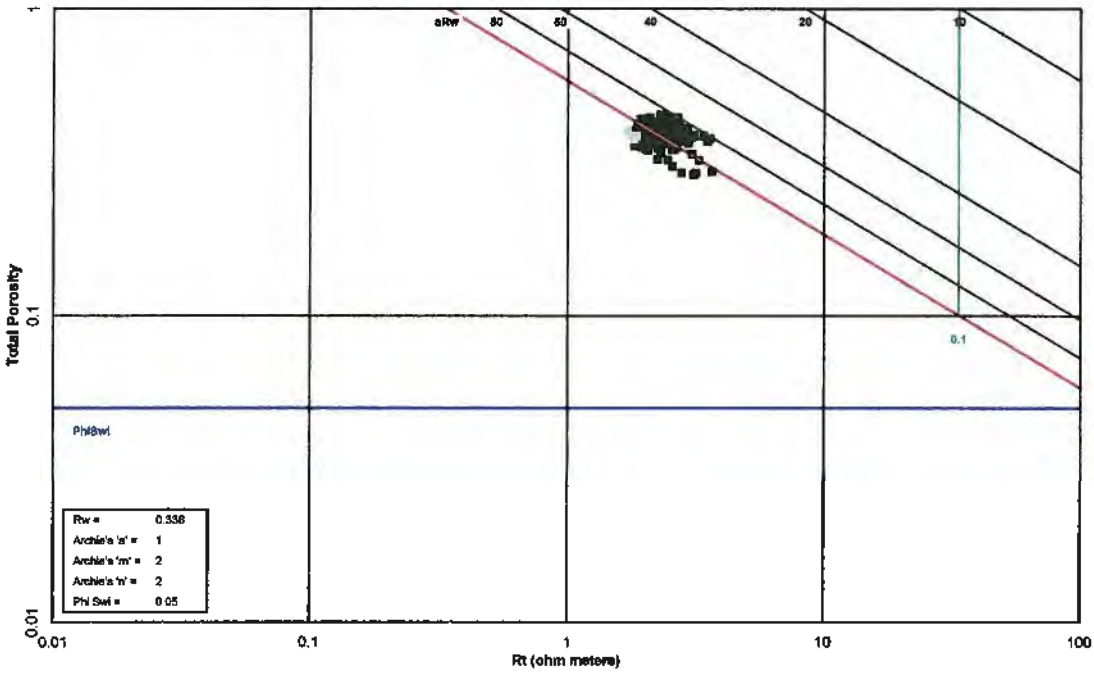
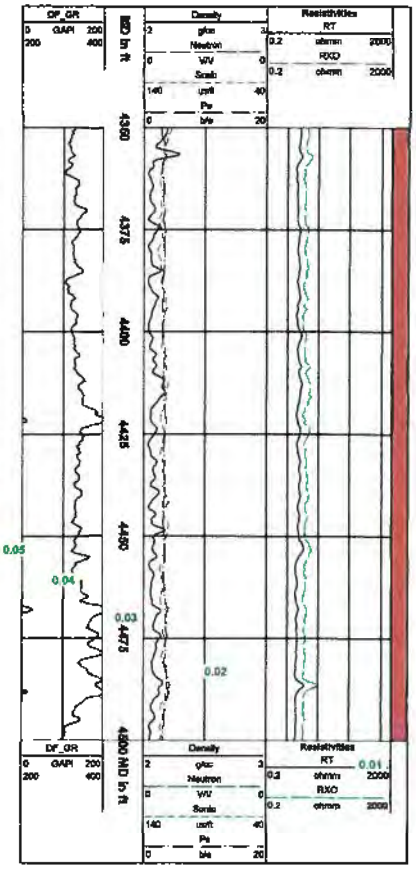
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
4350-4500
Time: 04:34 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T= 115

Rw= 0.338 Salinity 11000

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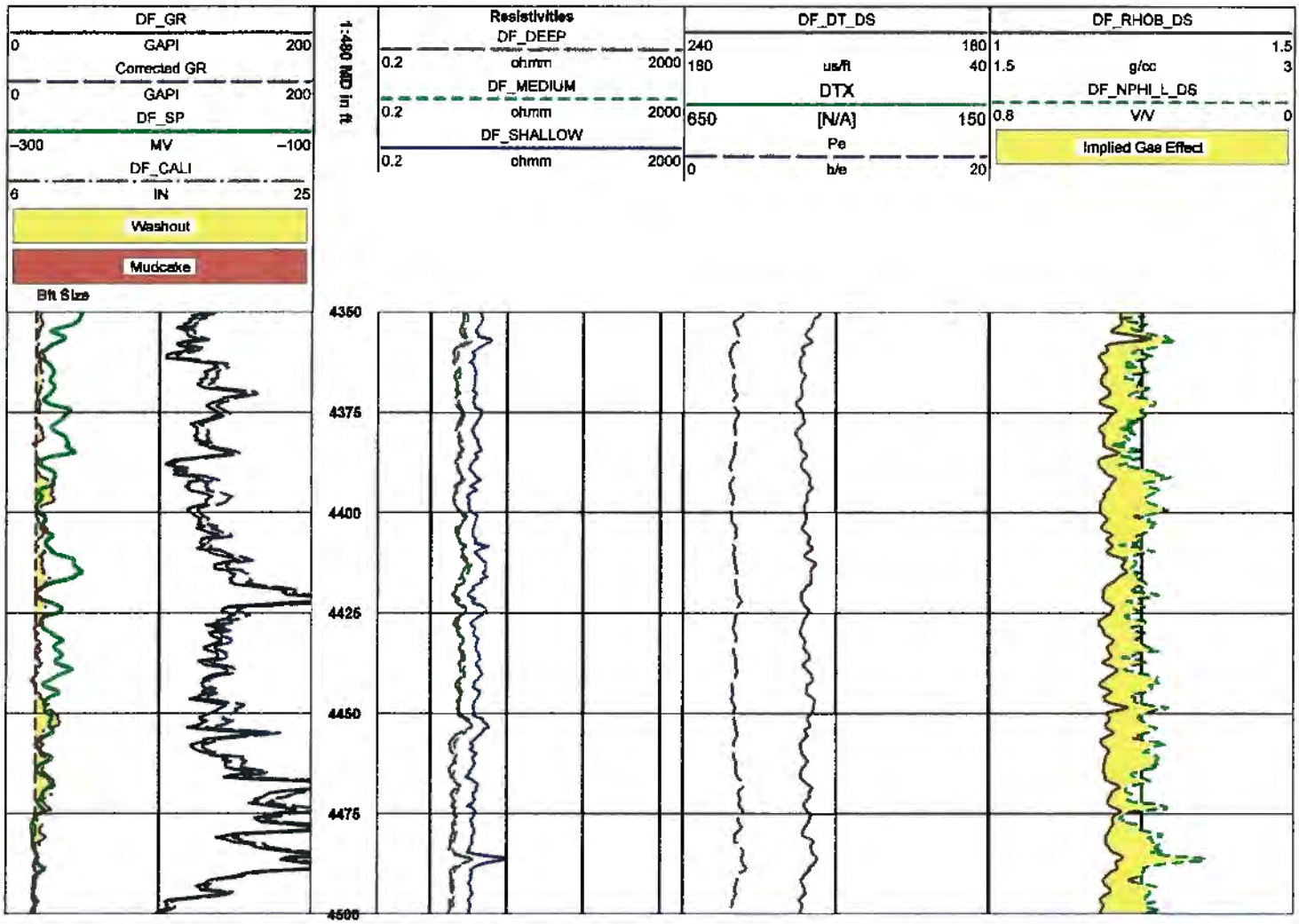
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
4350-4500
Time: 04:35 PM
Section: 28
Location:

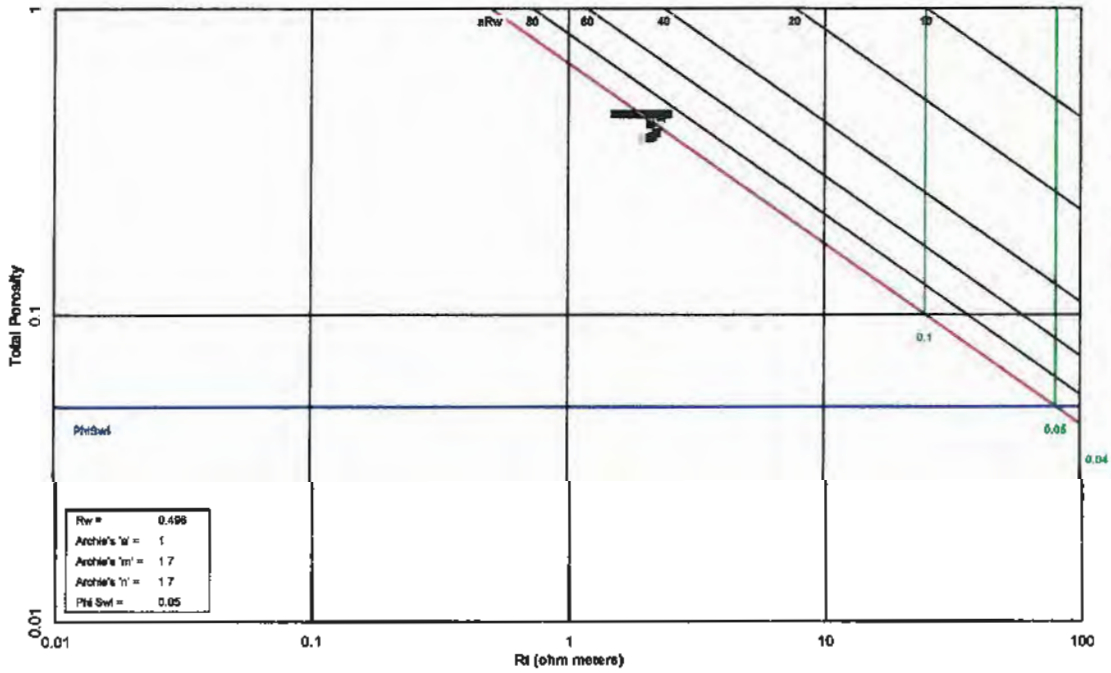
Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)
Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1

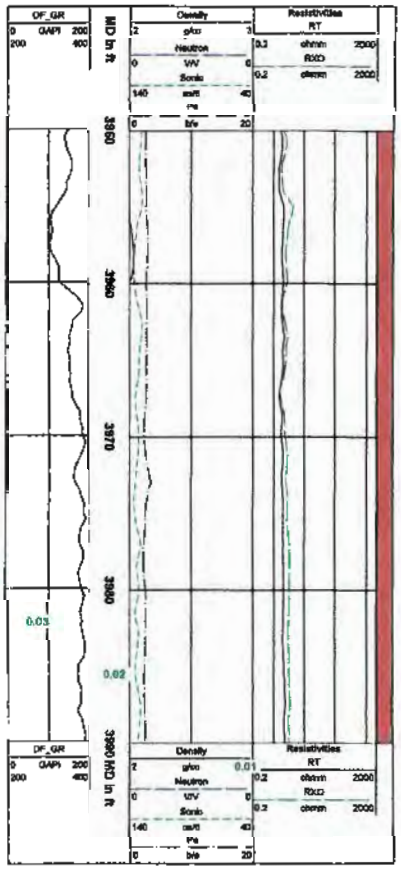


LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3950-3990
Time: 08:51 AM
Section: 25
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T = 108

Rw = 0.496 Swt 6000

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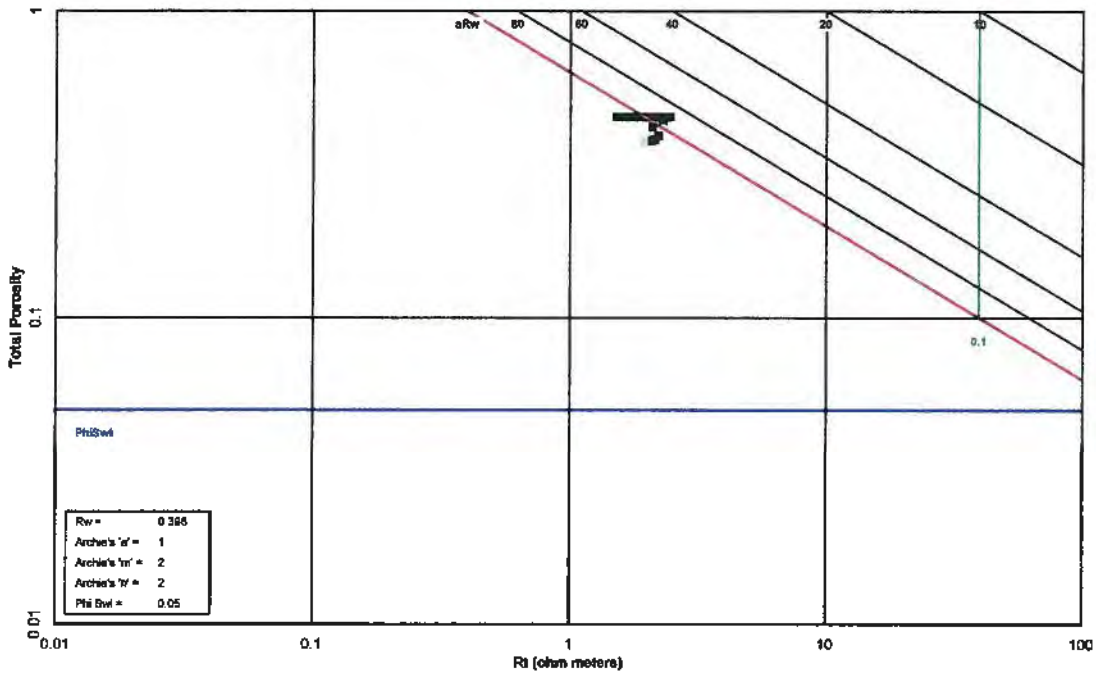
DIGITAL FORMATION

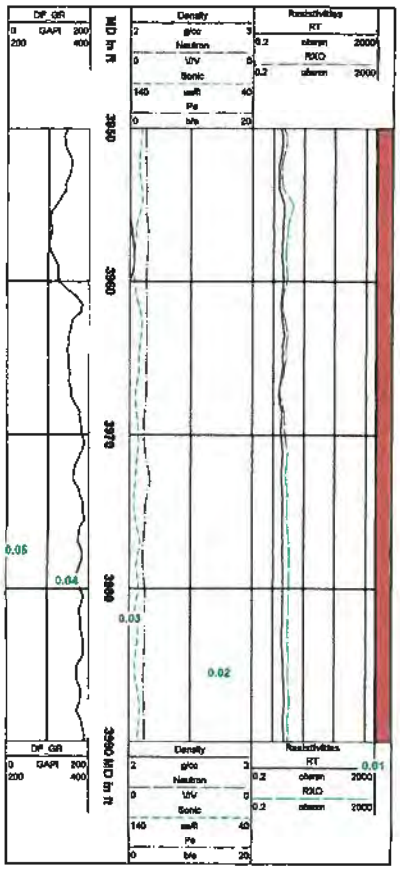
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3950-3990
Time: 04:13 PM
Section: 28
Location:

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

API #: 07720688
UWI: Citizen_Green_1





Y: 110°

Rw: 0.396 Saline 10,000

DIGITAL FORMATION

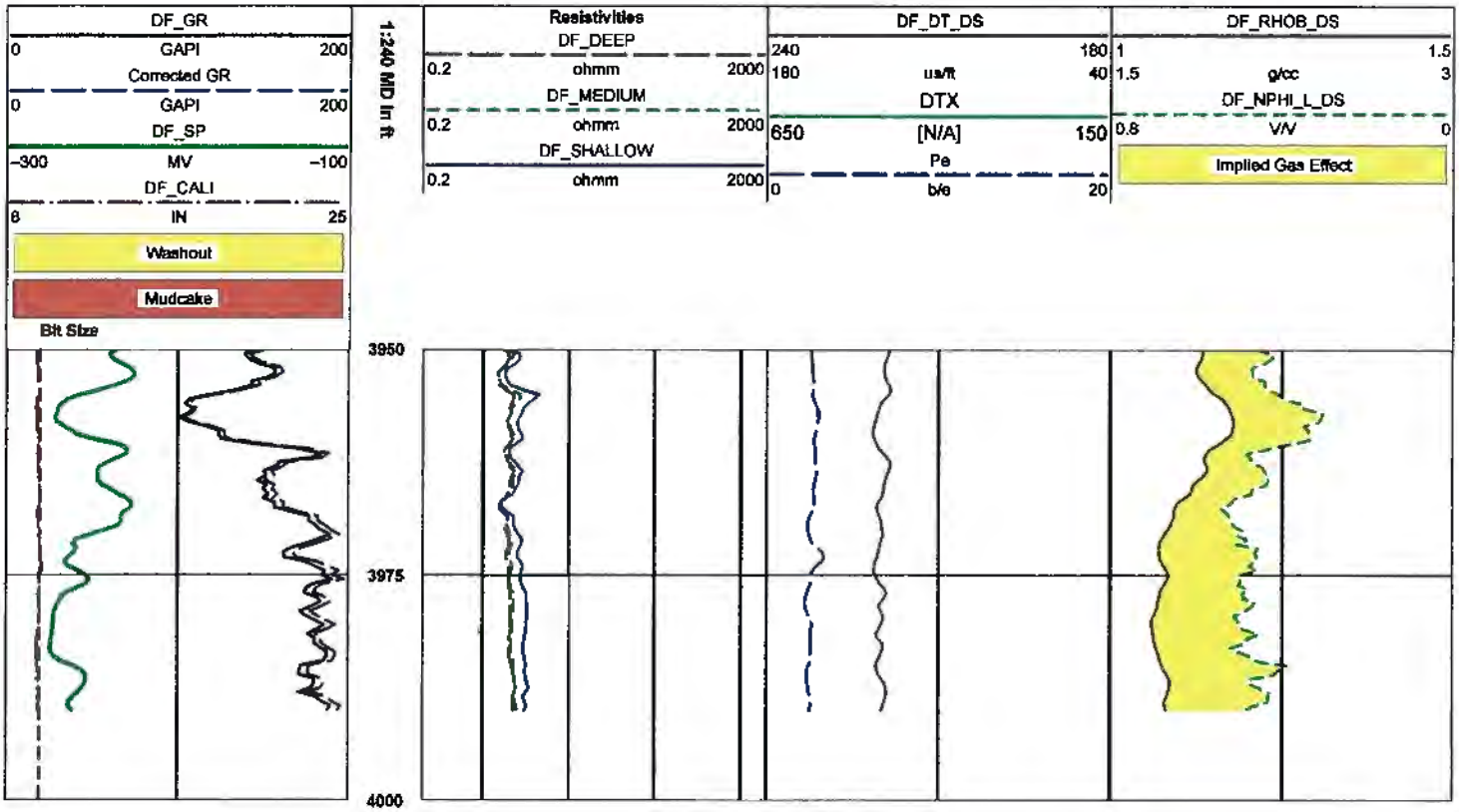
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3950-3990
Time: 04:13 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

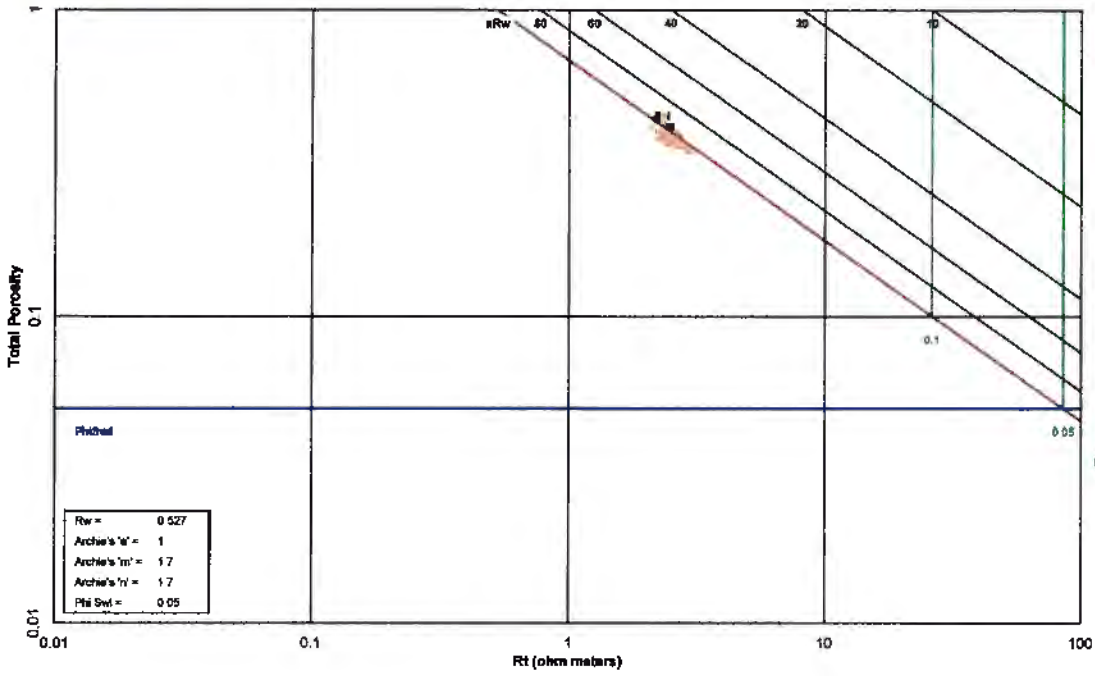


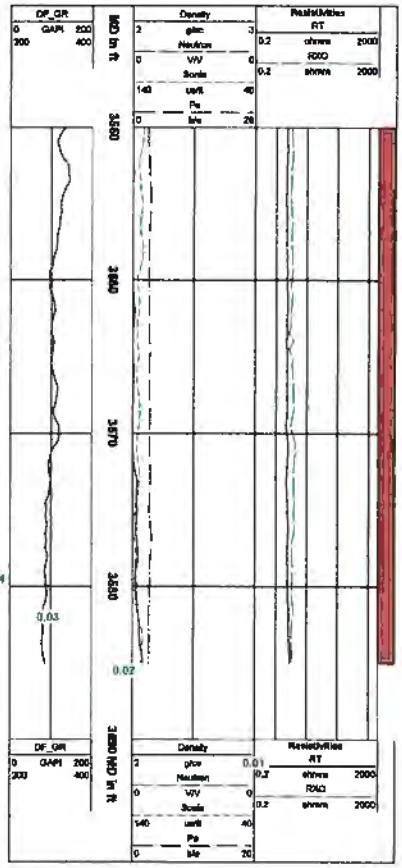
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3550-3585
Time: 08:50 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

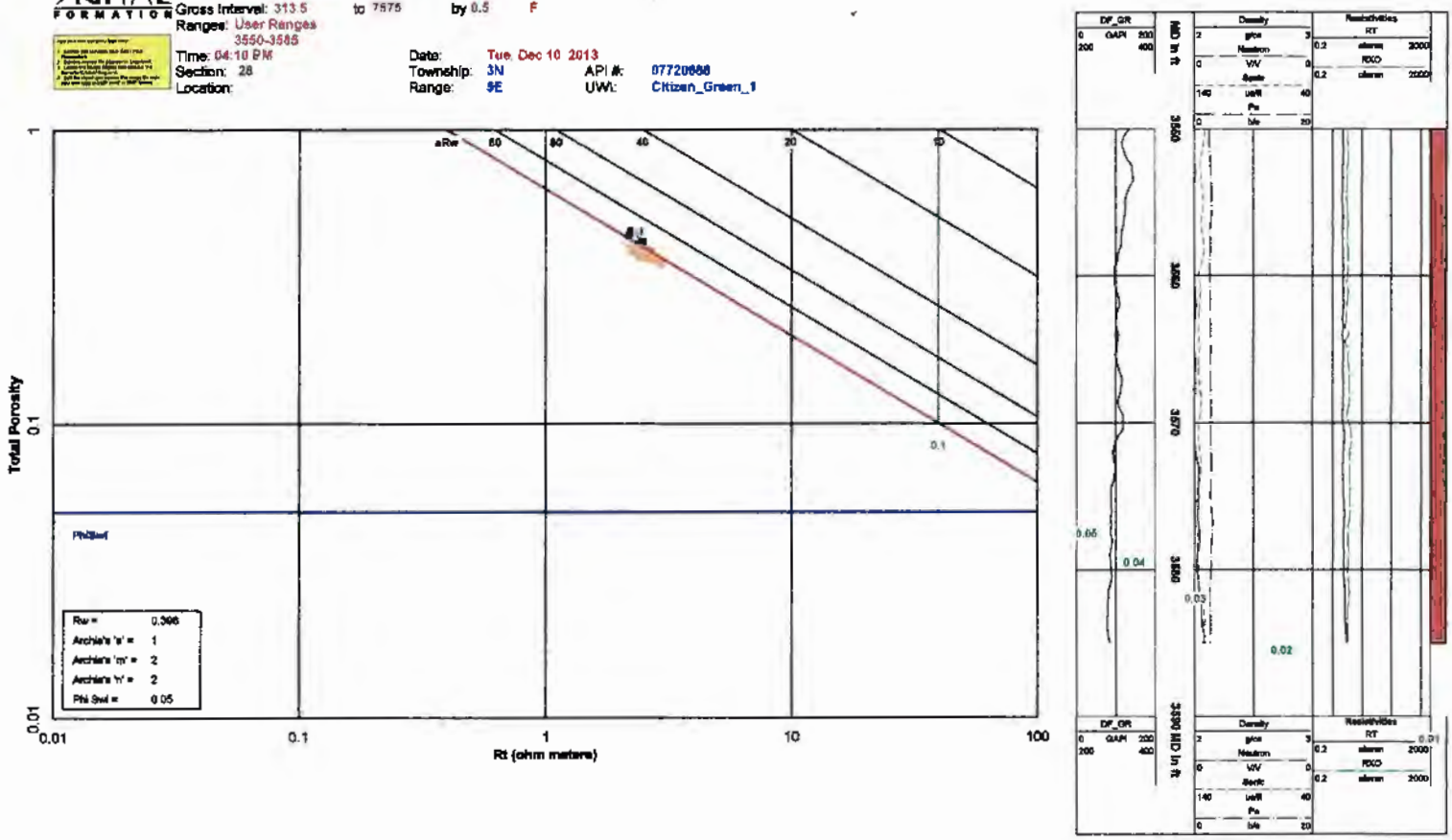
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720668
UWI: Citizen_Green_1





T = 106

Rw = 0.527 Salin. 8000



T= 103

Rw= 0.396 Saling 11,000

DIGITAL FORMATION

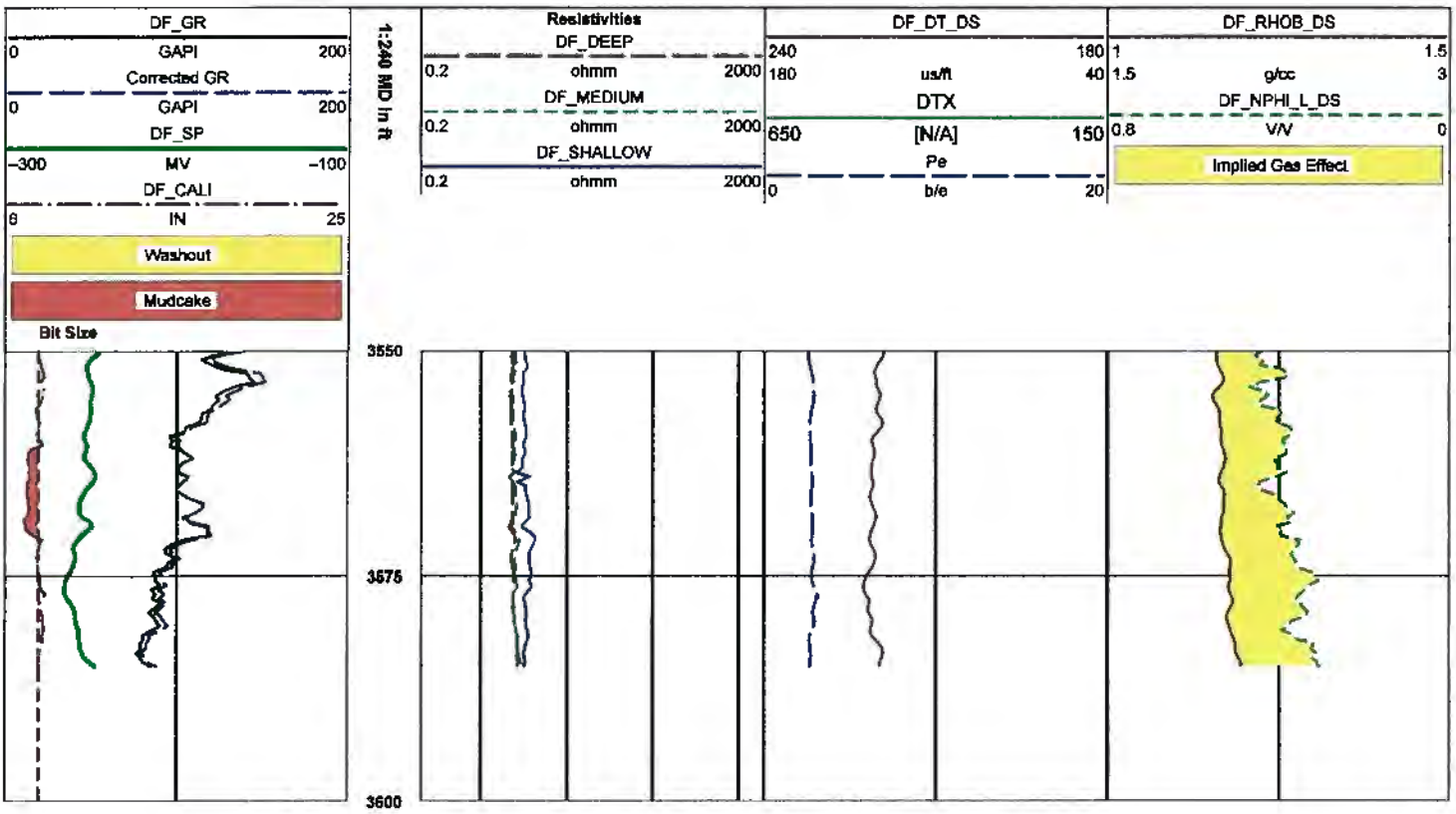
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3550-3585
Time: 04:09 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

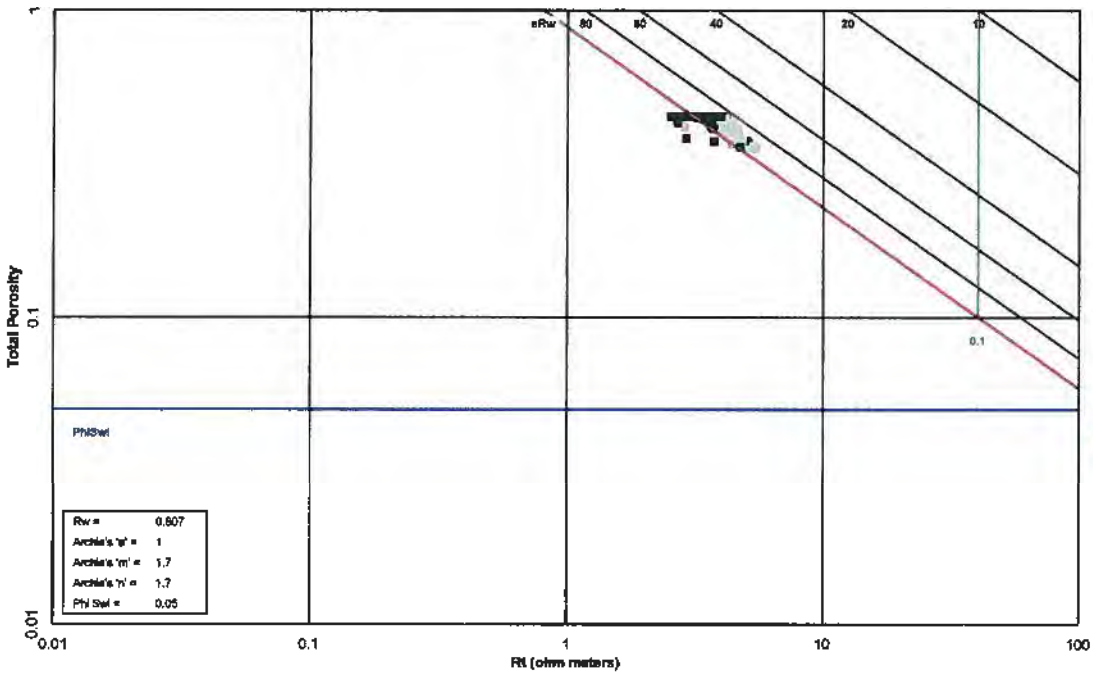


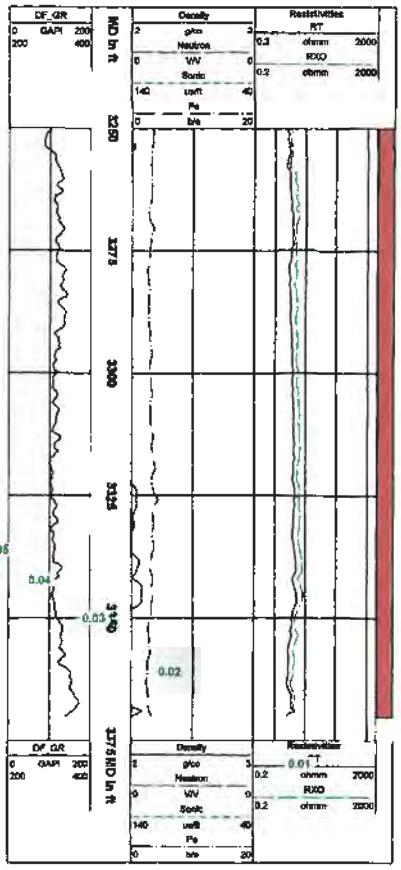
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3250-3370
Time: 08:48 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T = 103

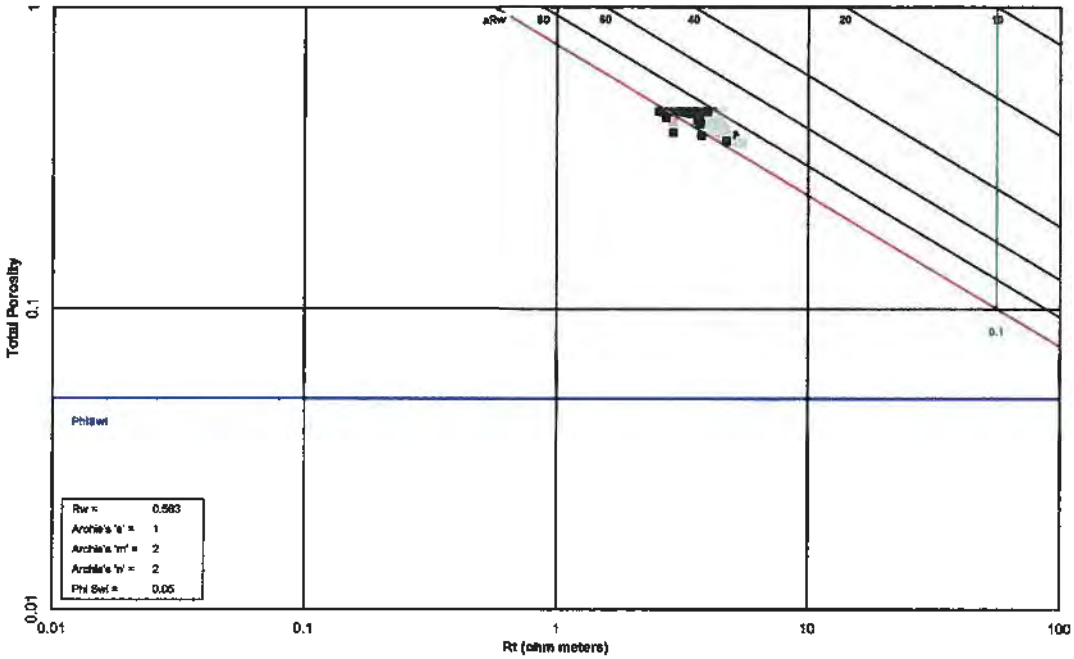
R_w = 0.807 Sw/sg 520

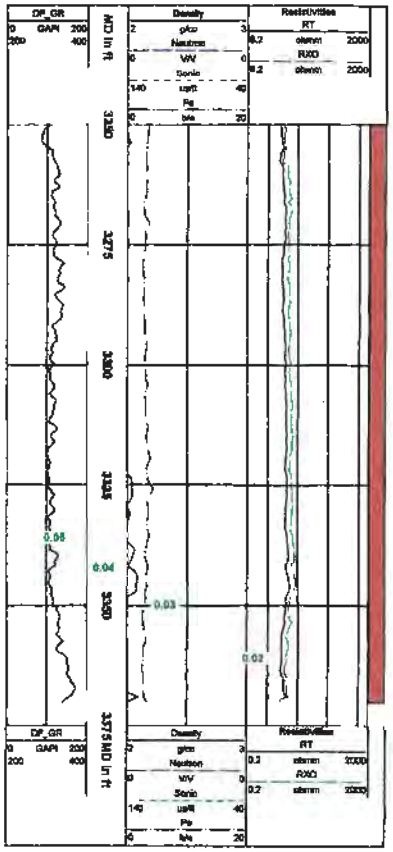
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3250-3370
Time: 04:05 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T: 100

Rw: 0.563 Salinity 8000

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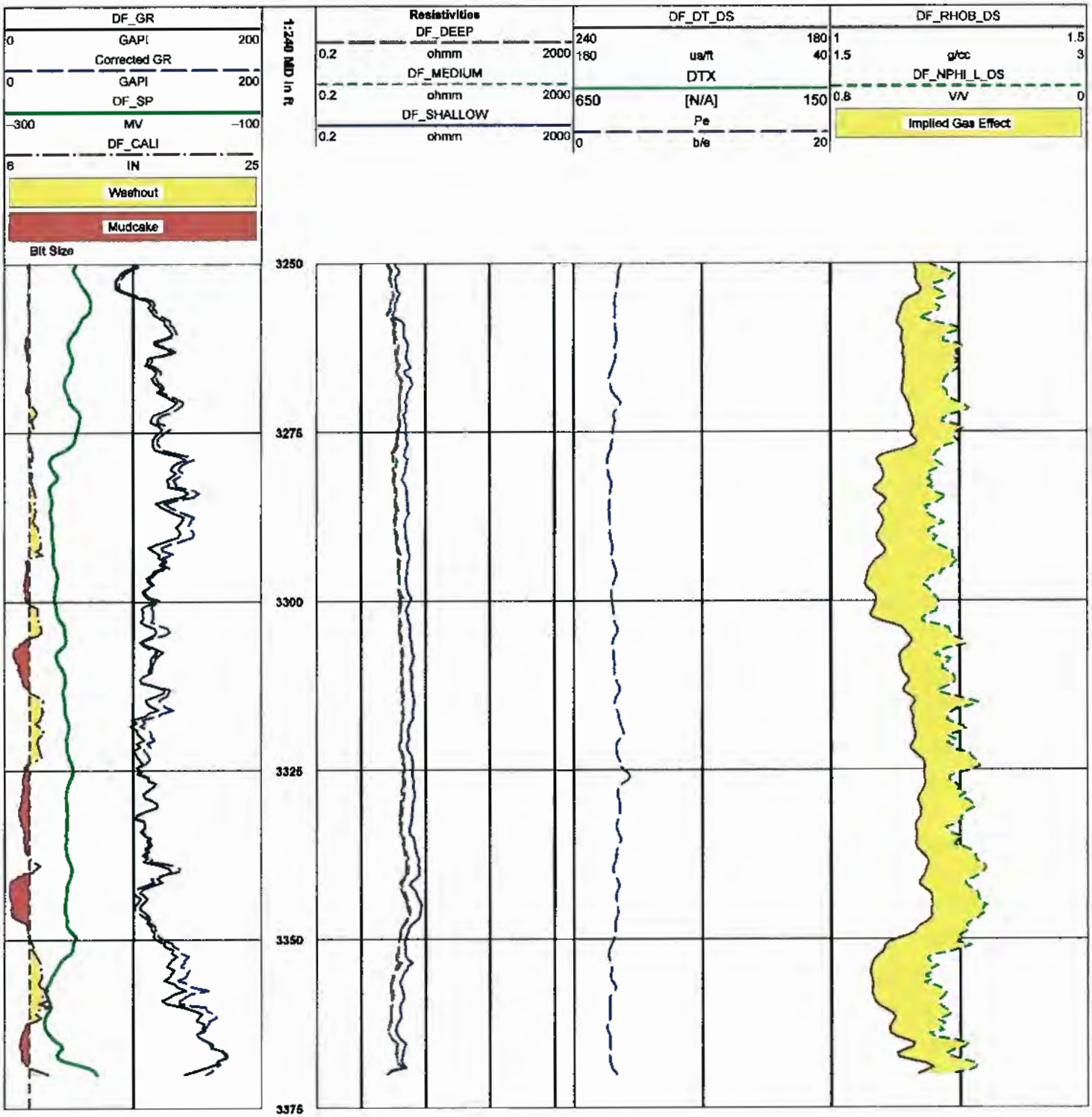
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
3250-3370
Time: 04:08 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



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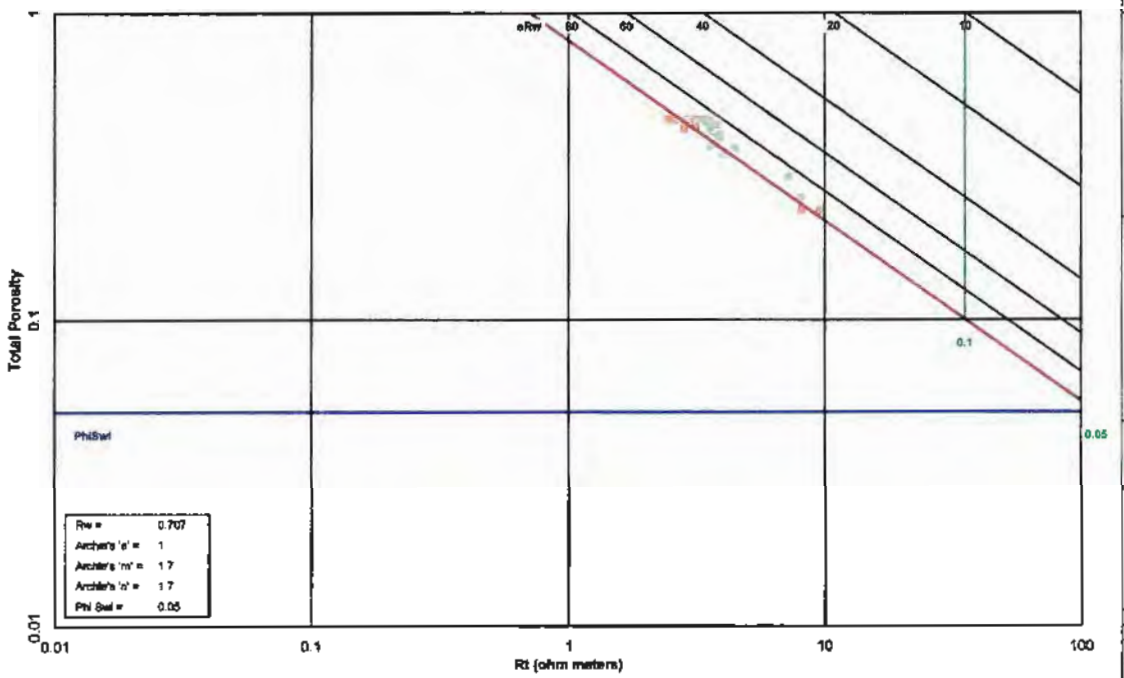
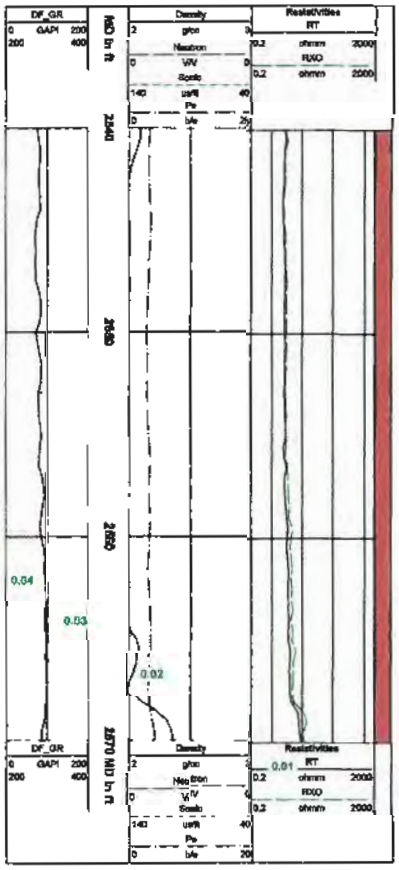
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2540-2570
Time: 08:46 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720666
UWI: Citizen_Green_1

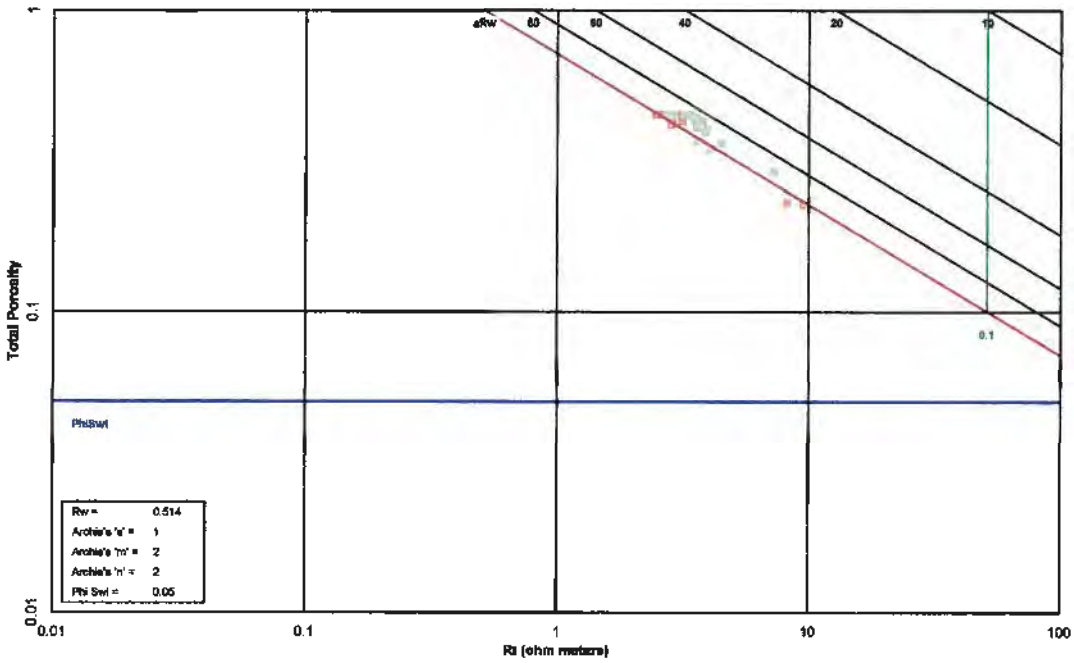


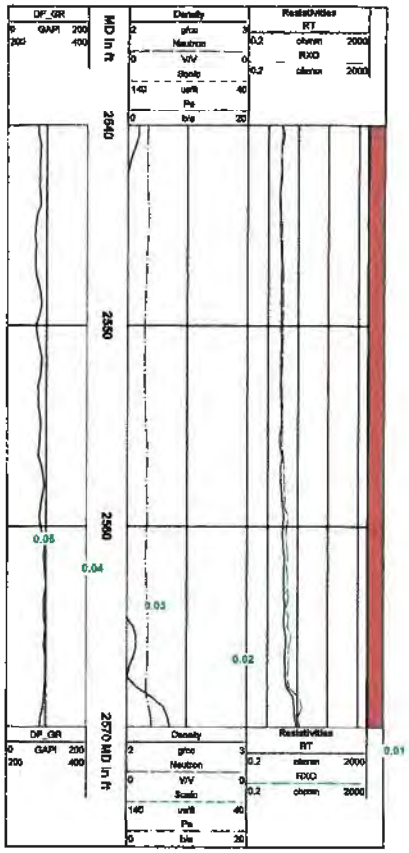


T = 93

Rw = 0.707 Sabg 6500

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.las
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2540-2570
Time: 03:55 PM
Section: 28
Location:
Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw
API #: 07720668
UWI: Citizen_Green_1





T= 90°

Rw 0.514 Salinity 10,000

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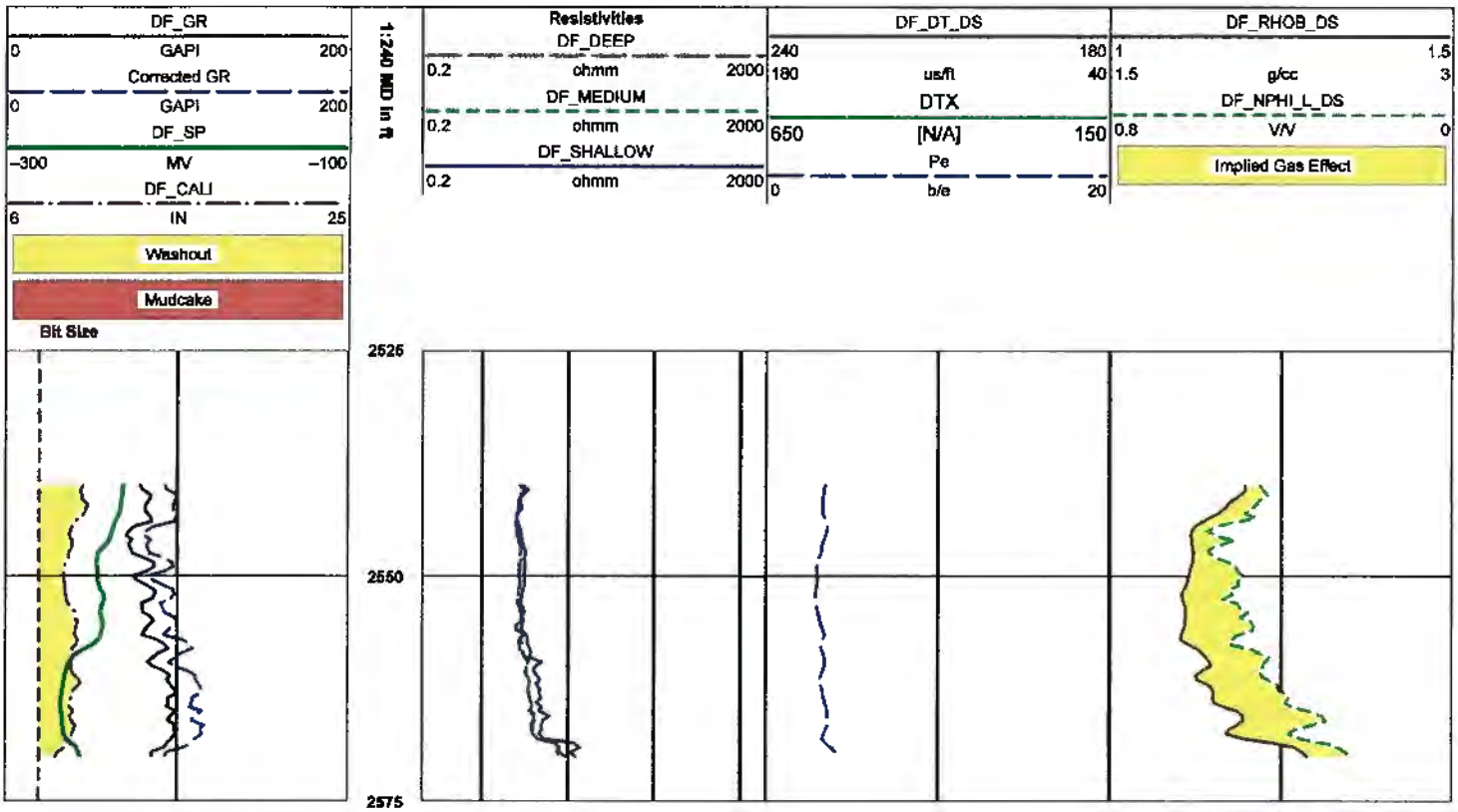
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2540-2570
Time: 03:54 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1



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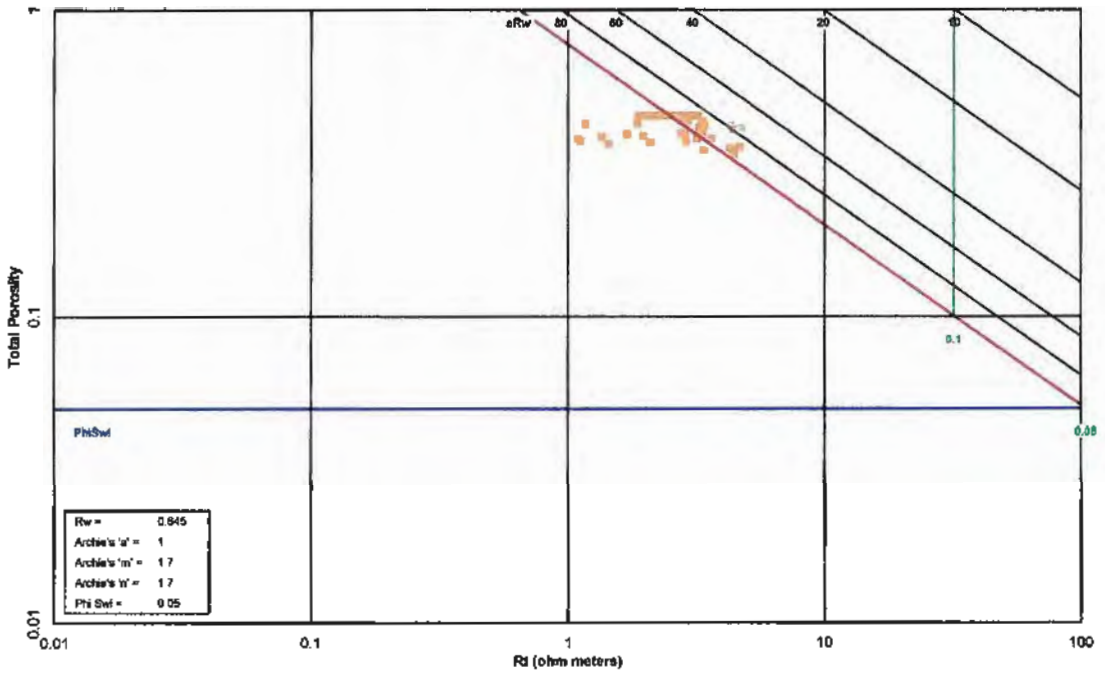
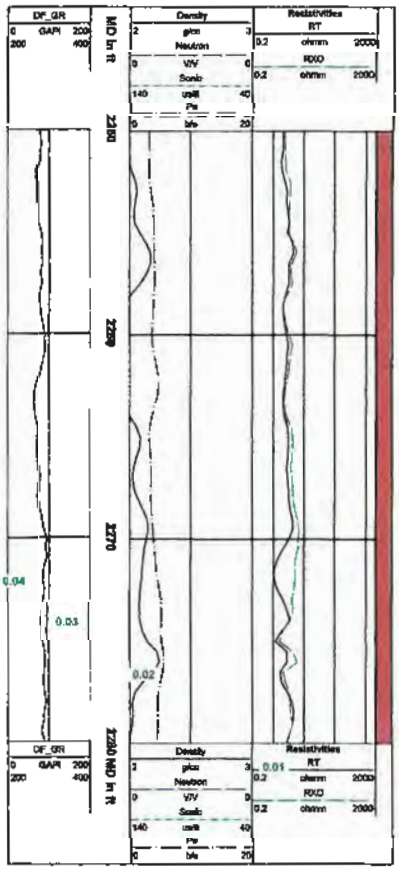
DIGITAL FORMATION

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2250-2280
Time: 08:44 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T_z 89

Rw: 0.645 Salty 7500

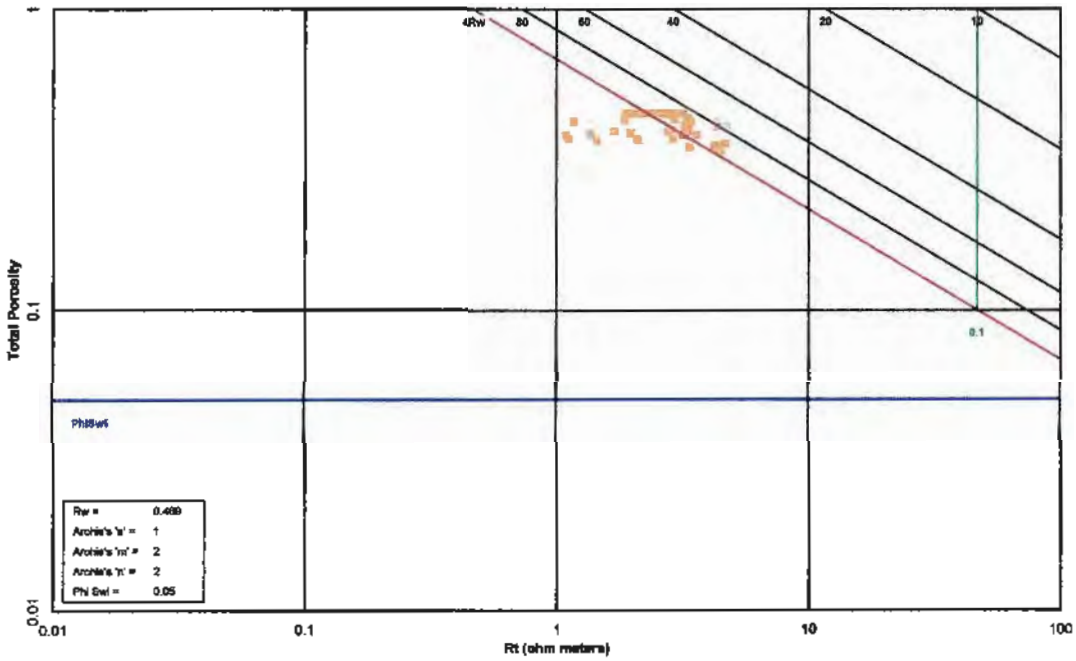
DIGITAL FORMATION

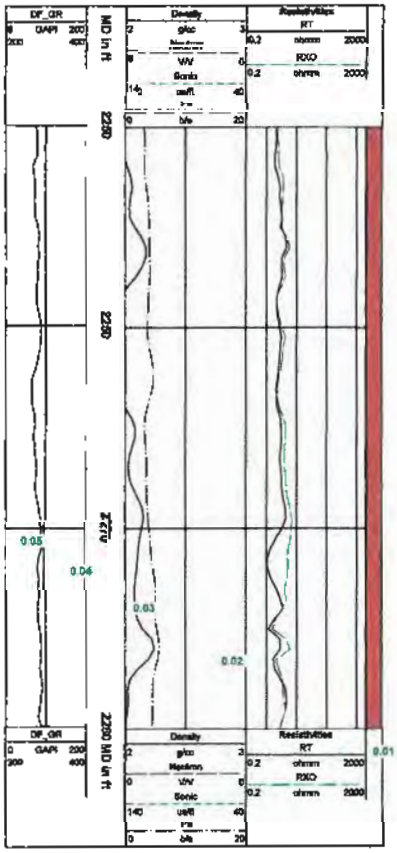
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2250-2280
Time: 03:53 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T. 89°

Rw: 0.469 Salinity 10,000

DIGITAL FORMATION

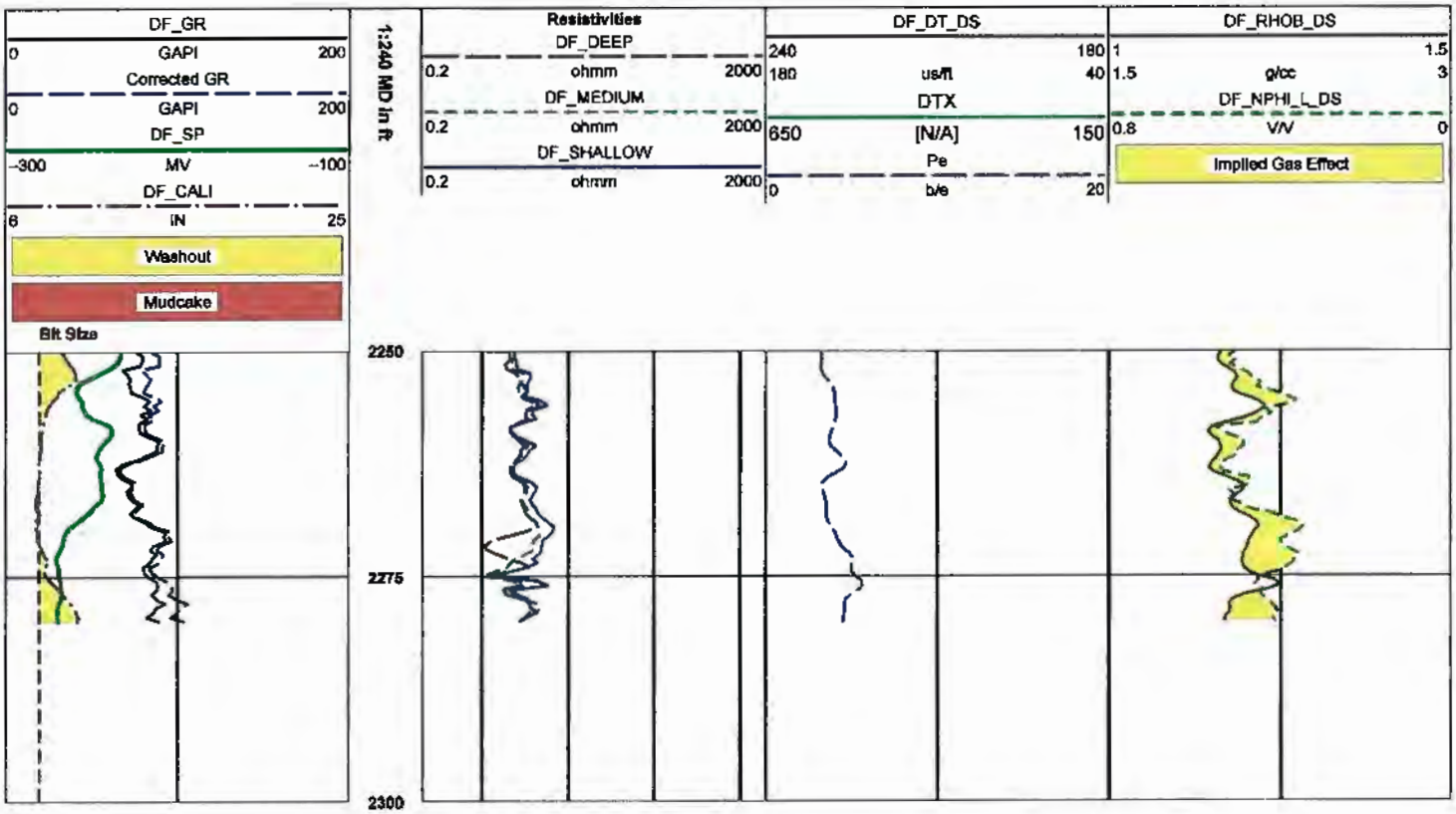
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2250-2280
Time: 03:53 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



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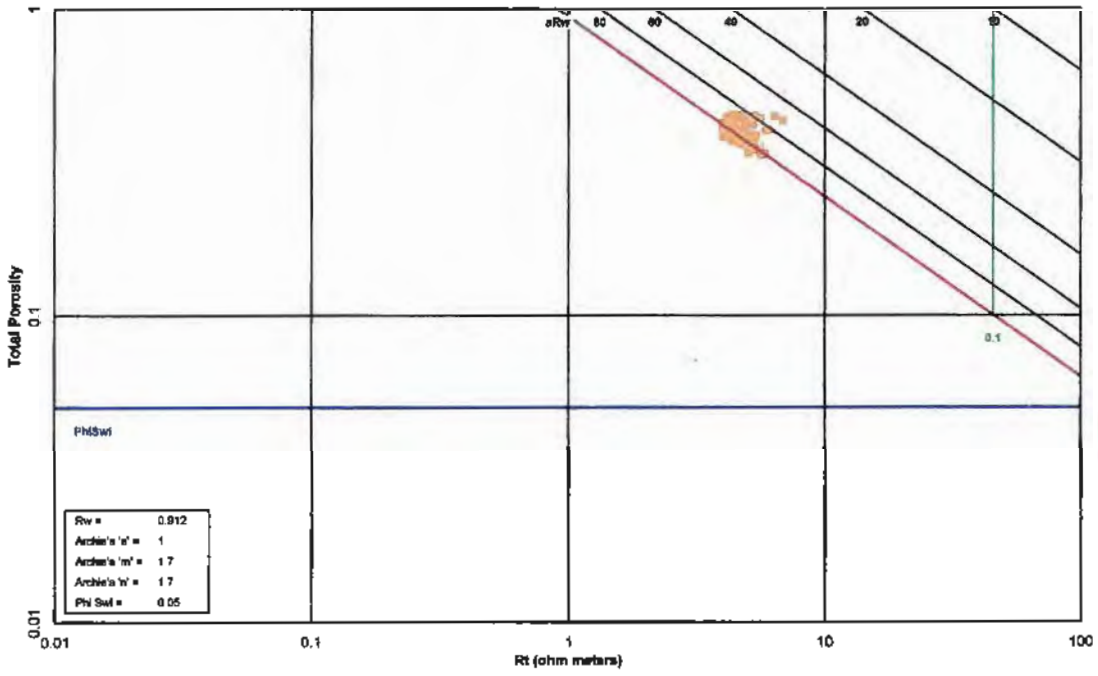
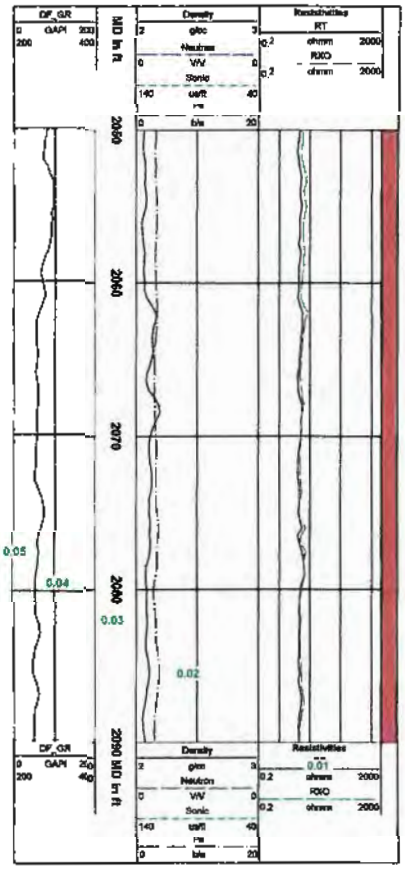
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges 2050-2090
Time: 08:42 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720888
UWI: Citizen_Green_1





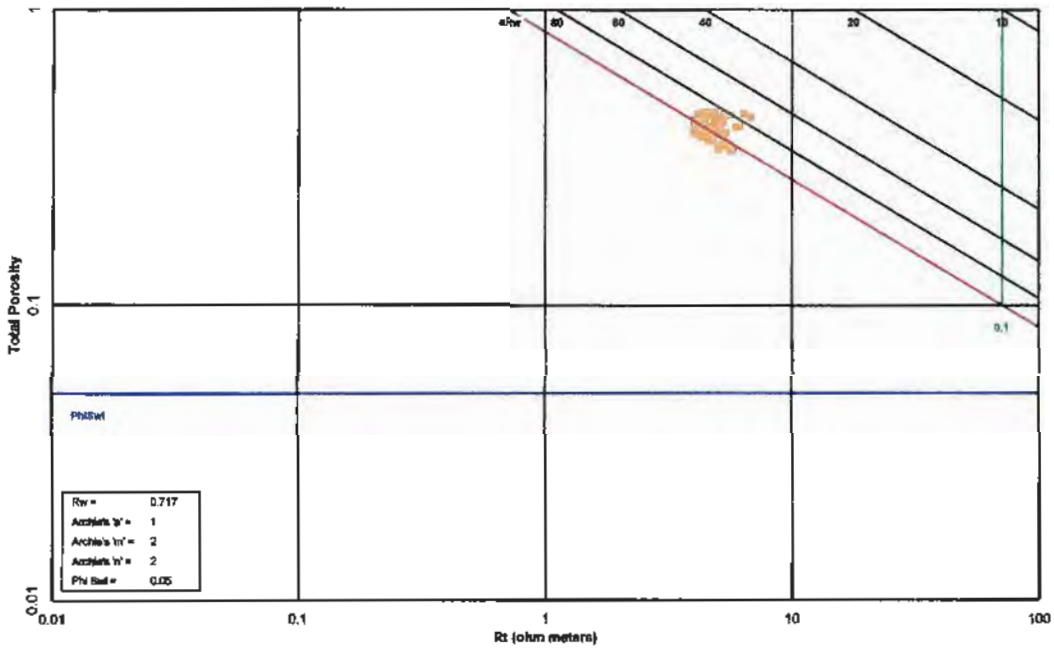
T= 87

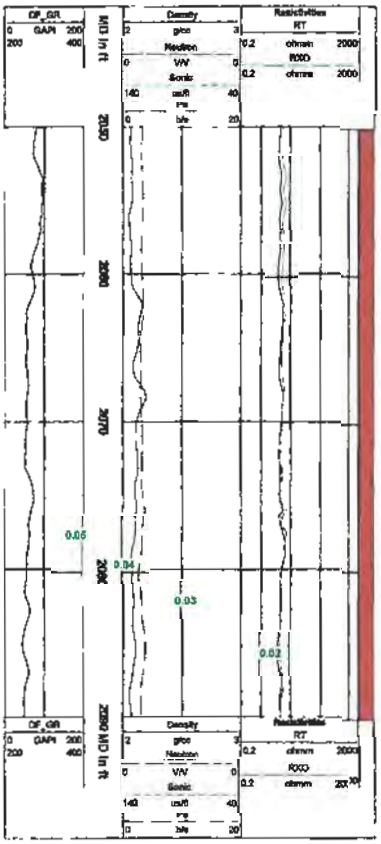
Rw= 0.912 Sahp 5500

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lhs
Plot:
Gross Interval: 313.6 to 7575 by 0.5 F
Ranges: User Ranges
2050-2090
Time: 03:51 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720668
UWI: Citizen_Green_1





T= 88°F

Rw = 0.717 Salinity 7500

DIGITAL FORMATION

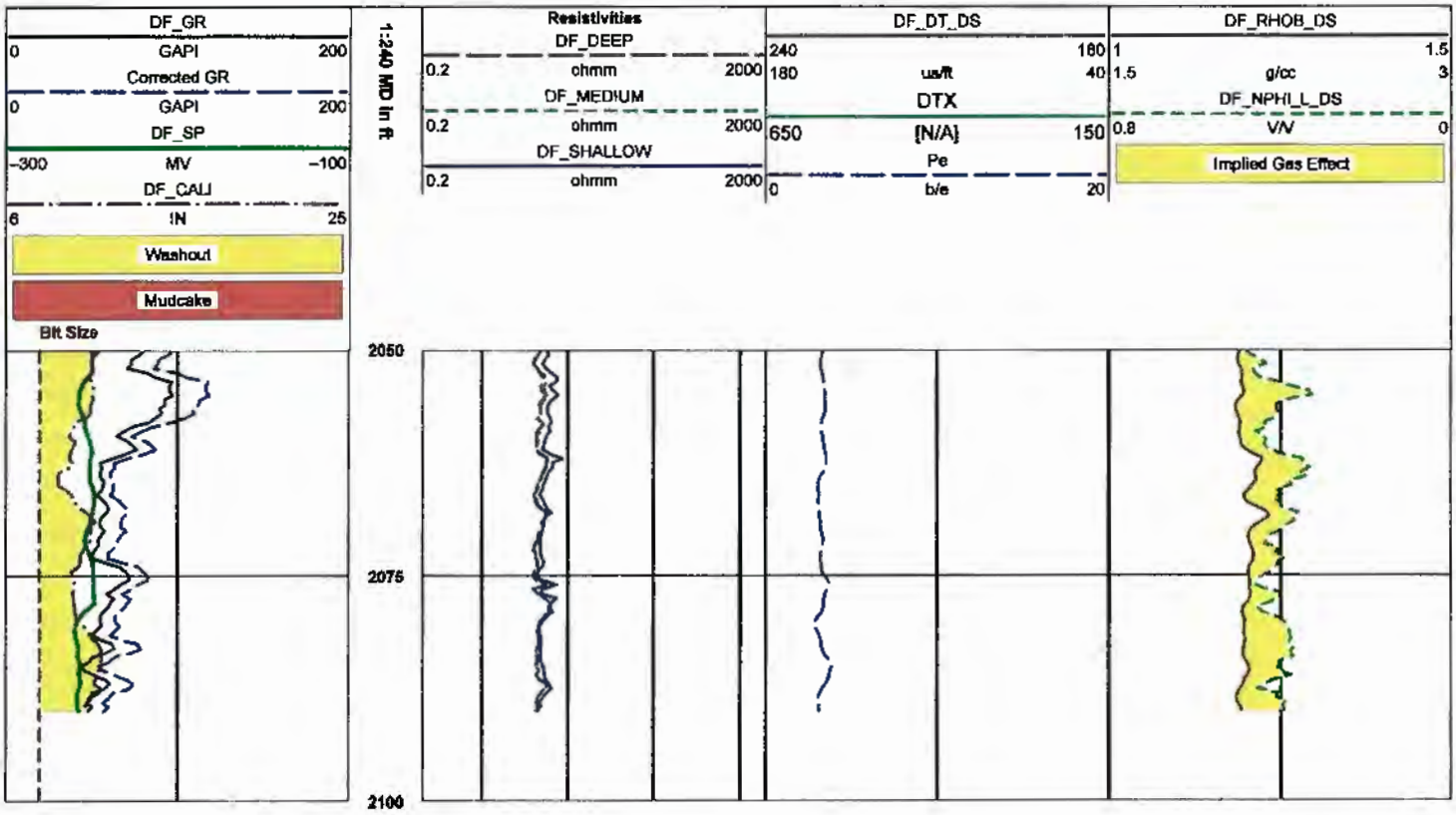
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
2050-2090
Time: 03:50 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



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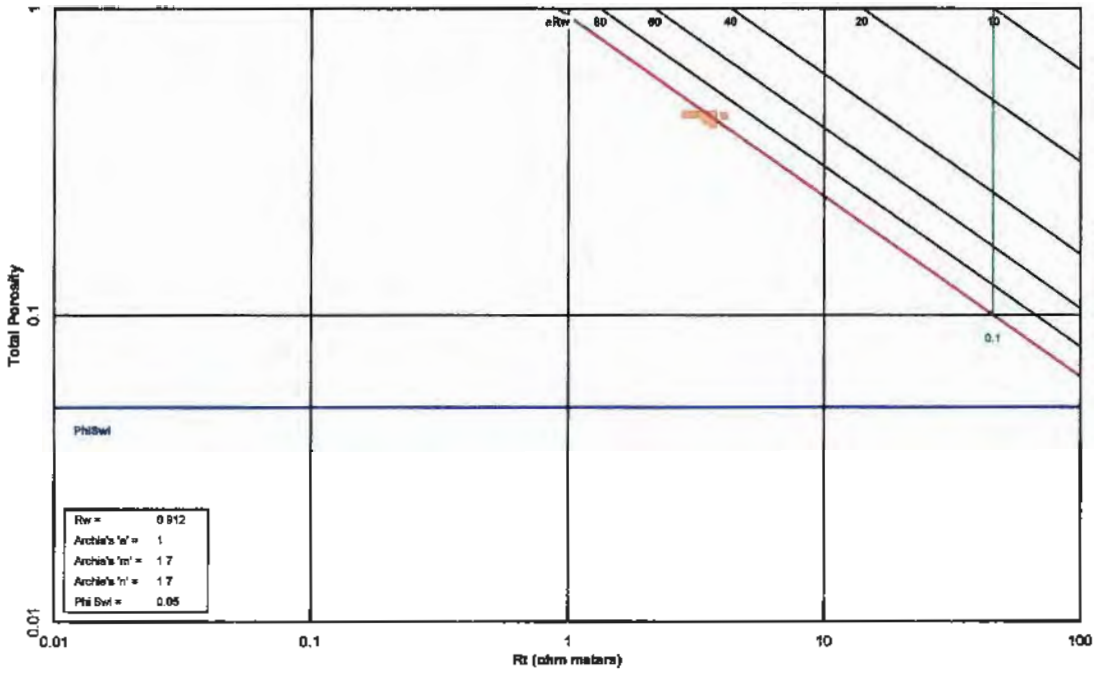
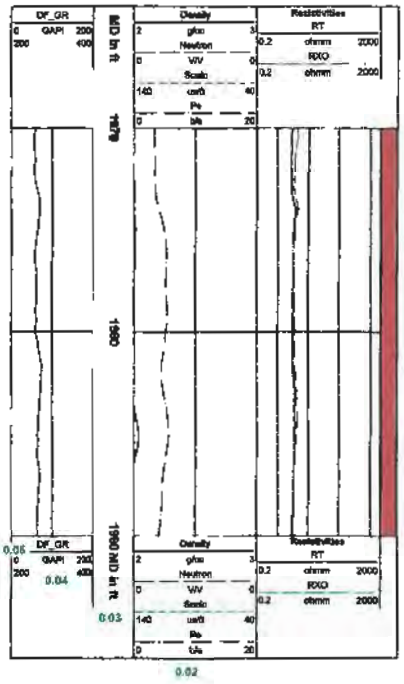
DIGITAL FORMATION

File: Citizen Green 1.las
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1970-1990
Time: 08:40 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T: 86°

R_{wa} 0.912 Salt 5500

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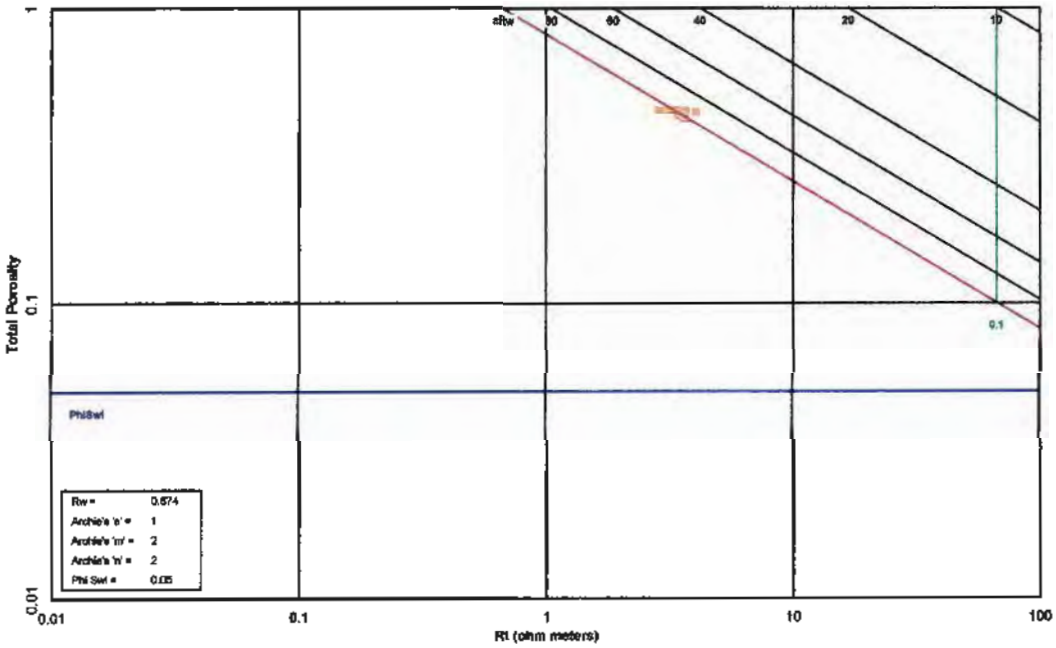
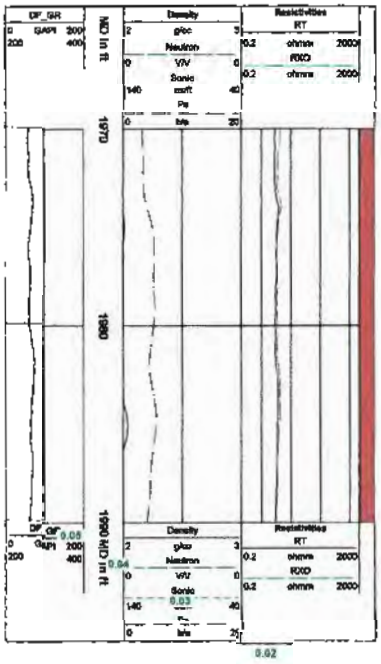
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1970-1990
Time: 03:46 PM
Section: 28
Location:

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

API #: 07720688
UWI: Citizen_Green_1





T= 83°

Rw= 0.674 In 7000

DIGITAL FORMATION

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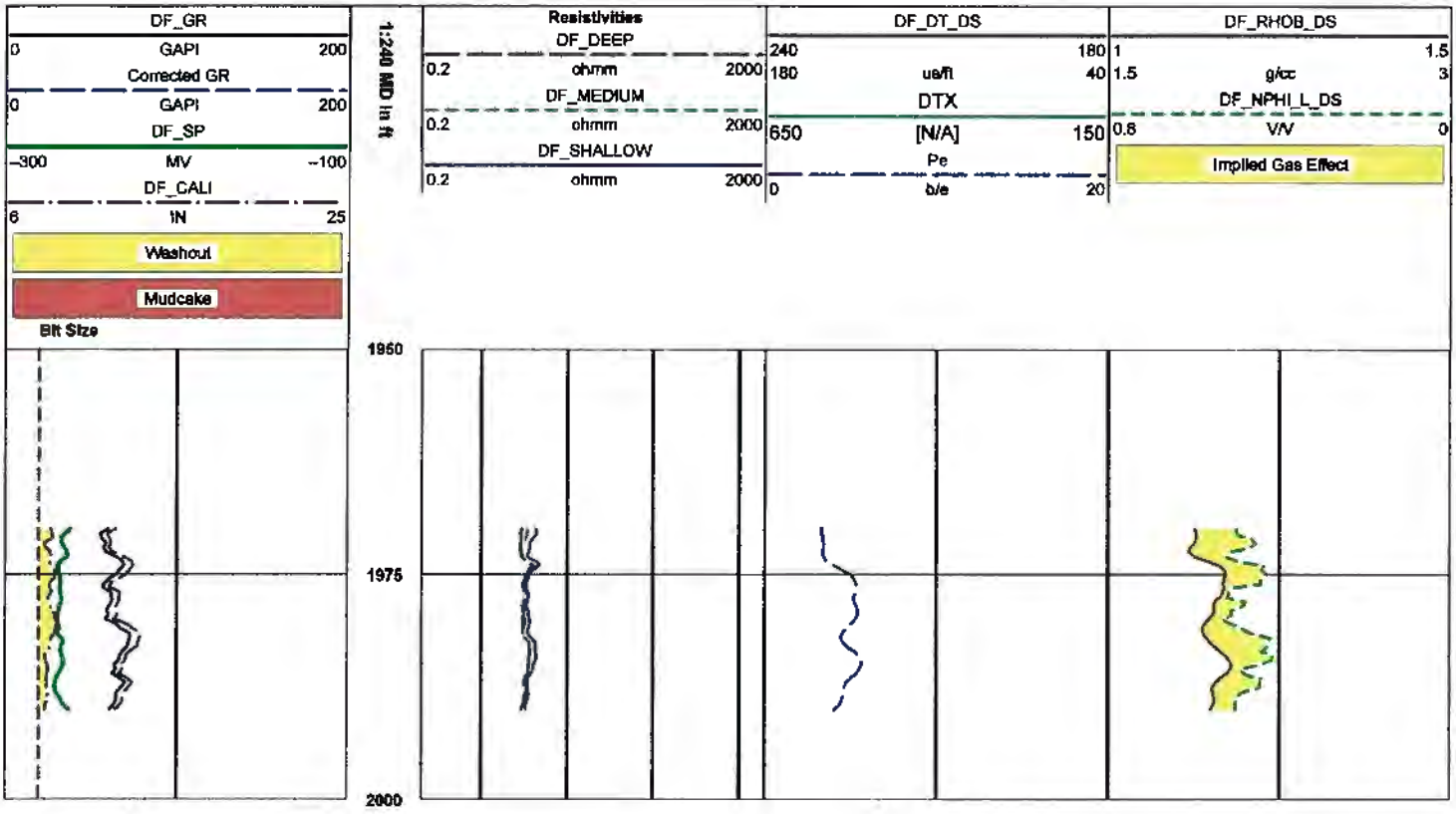
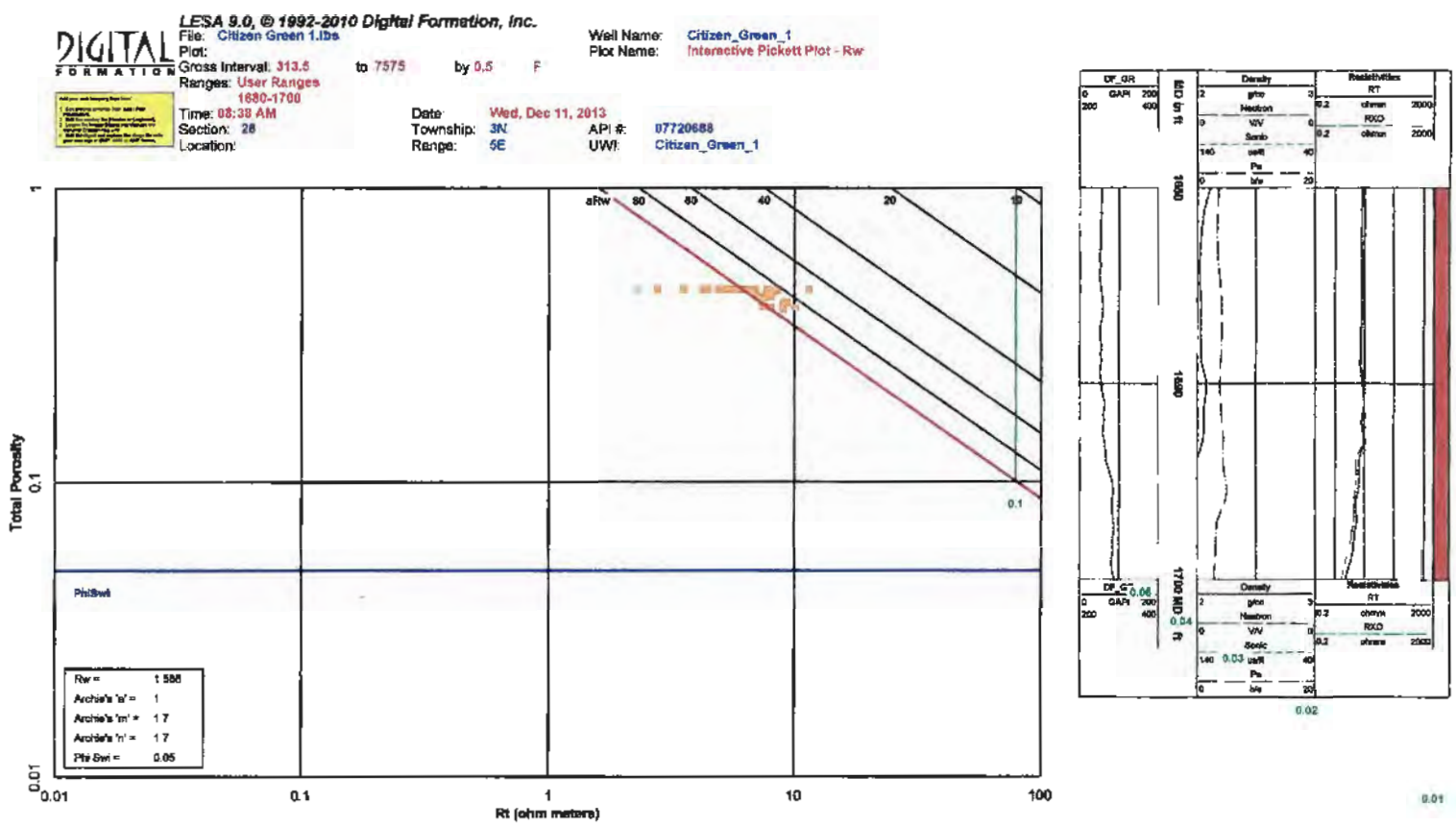
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1970-1990
Time: 03:49 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1





T: 82°

Rw: 1.586 Salinity: 3300

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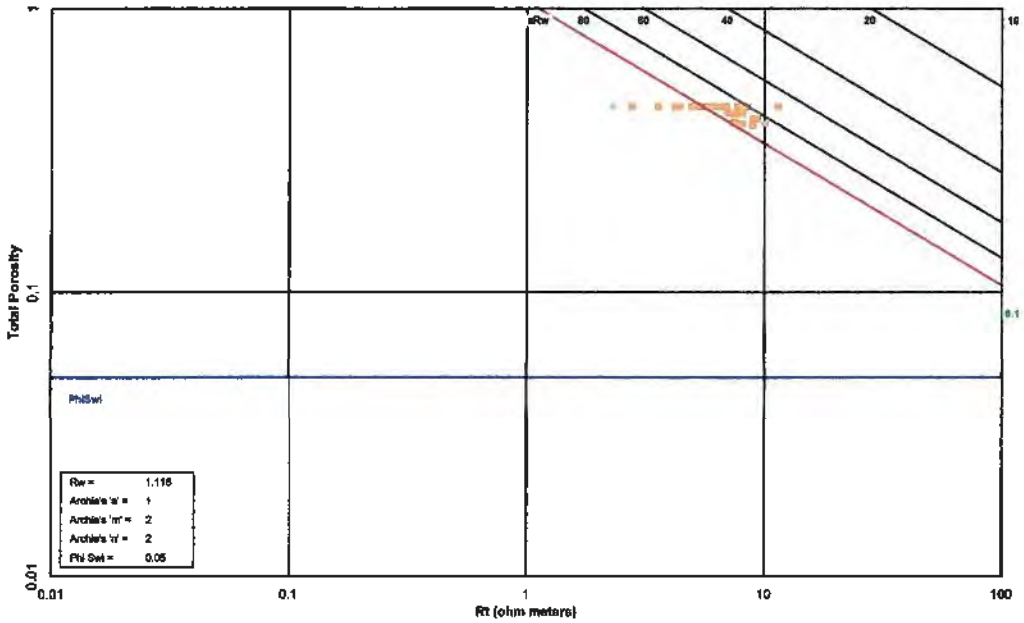
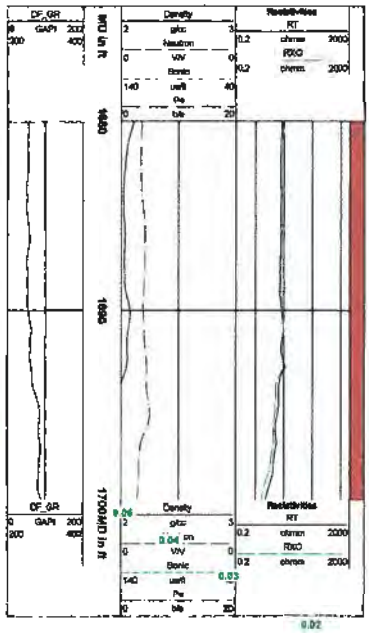
File: Citizen Green 1.ftx
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1680-1700
Time: 03:47 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720888
UWI: Citizen_Green_1





T = 80°

Rw = 1.118 Salinity 4500

DIGITAL FORMATION

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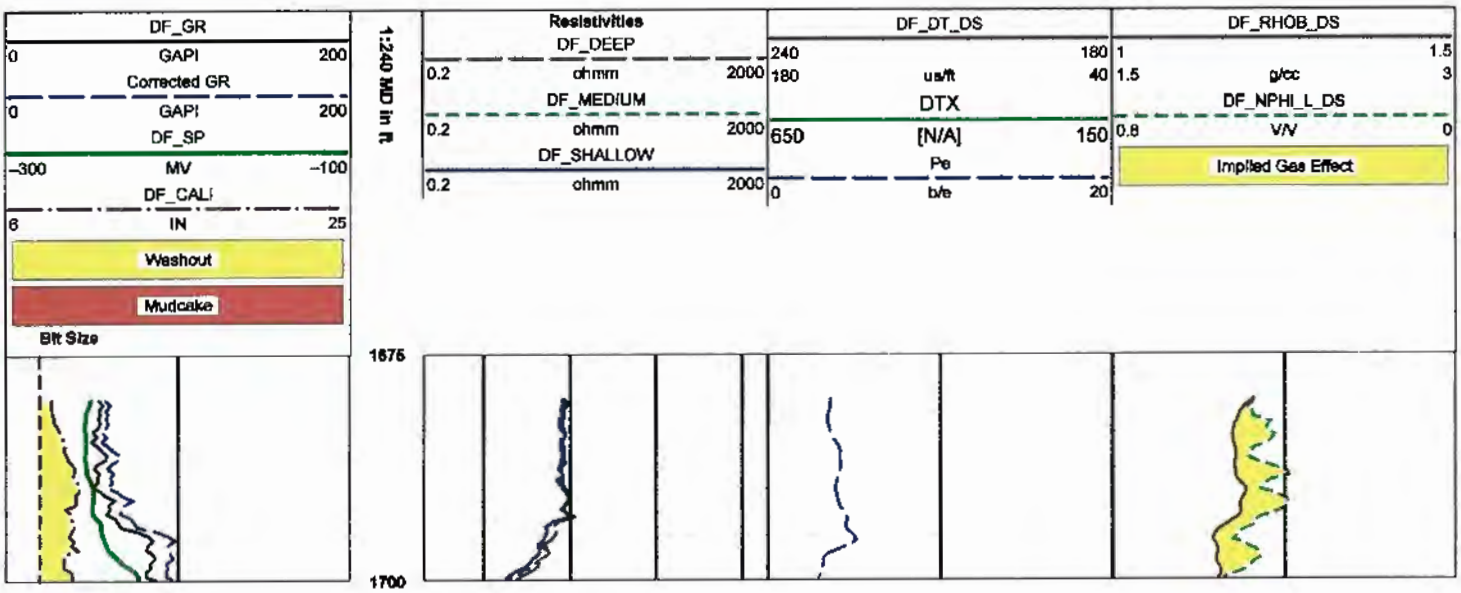
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1680-1700
Time: 03:46 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

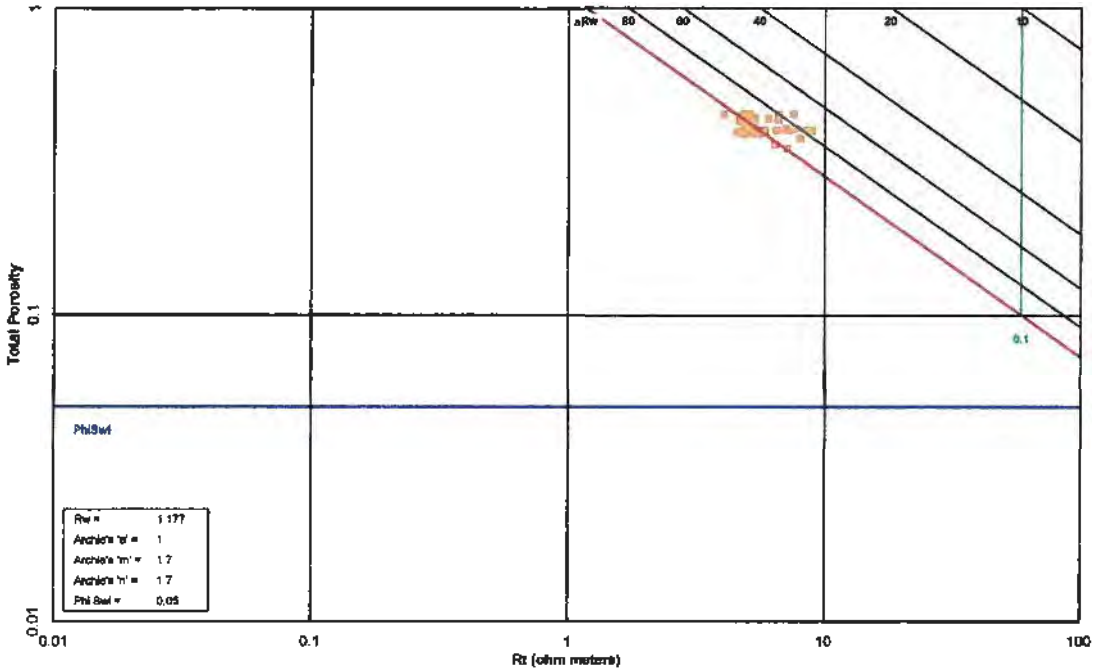
API #: 07720688
UWI: Citizen_Green_1

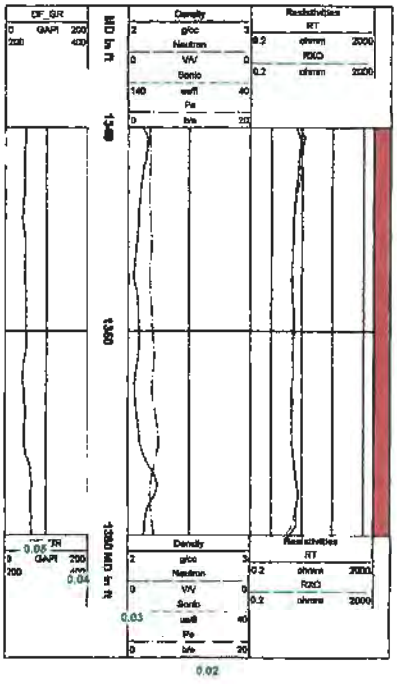


T = 80°

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1340-1360
Time: 08:36 AM
Section: 28
Location:

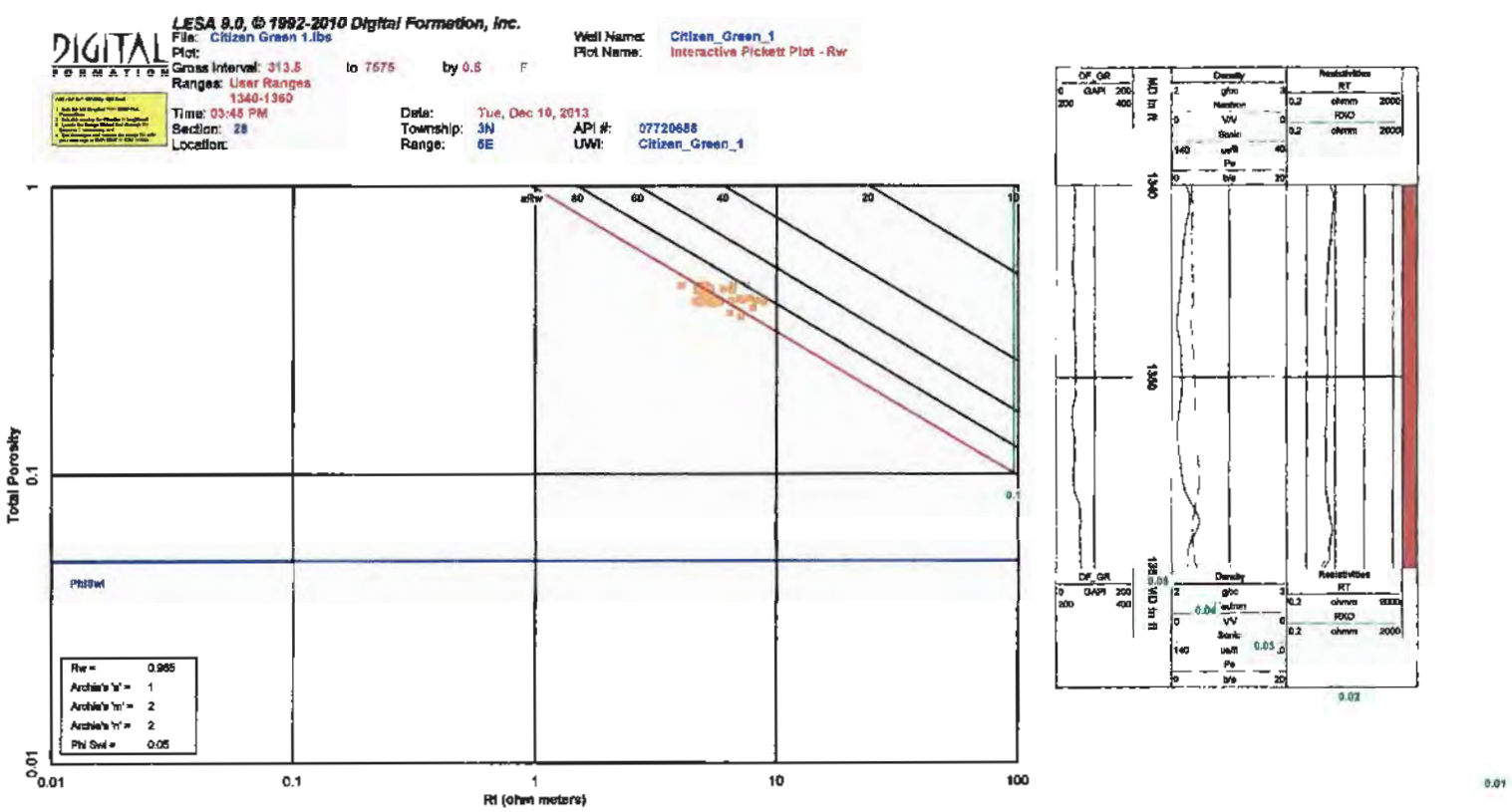
Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T. 776

Rw 1.177 Salinity 4506



T: 75°F

Rw: 0.965 Salt 6000

DIGITAL FORMATION

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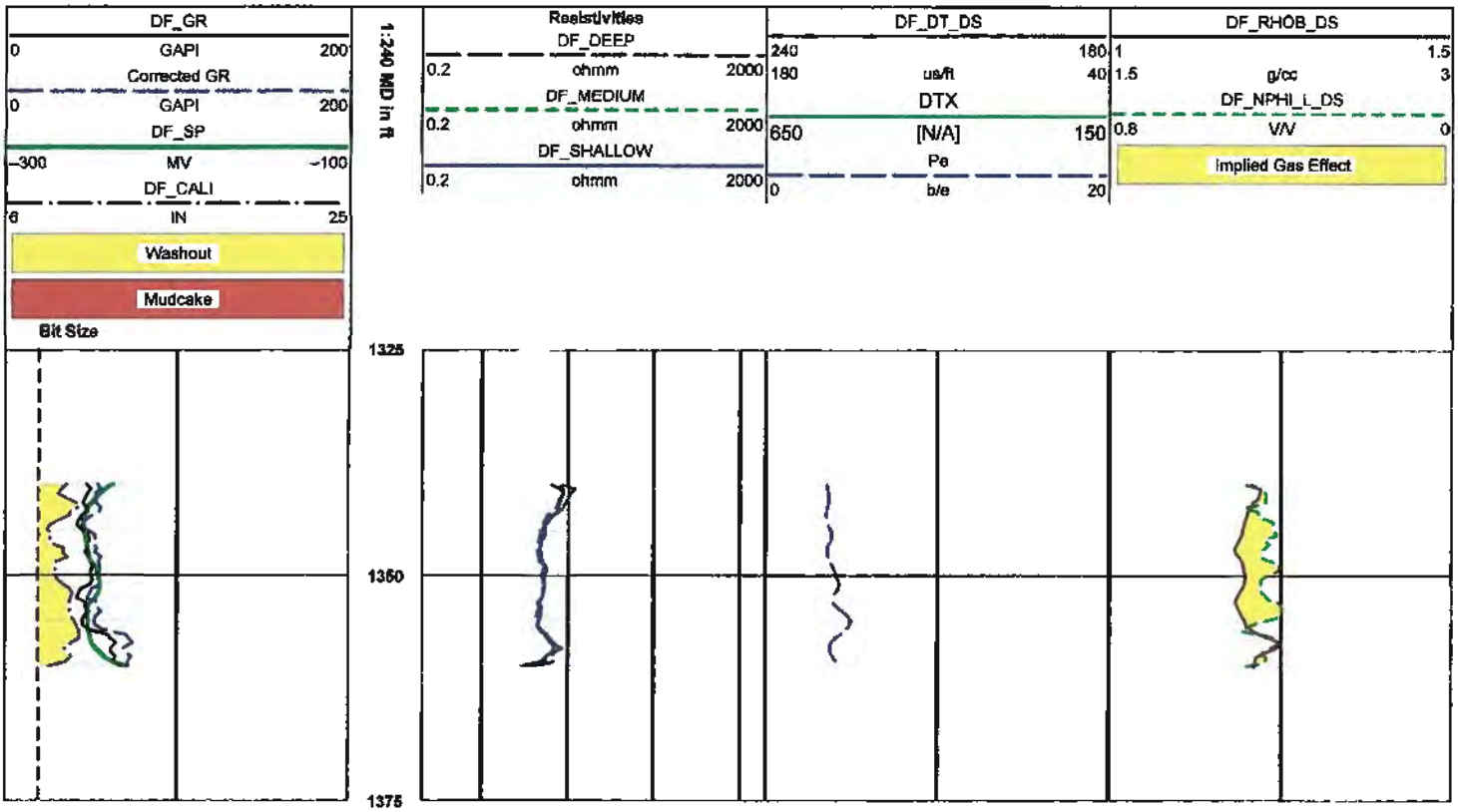
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
1340-1360
Time: 03:46 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



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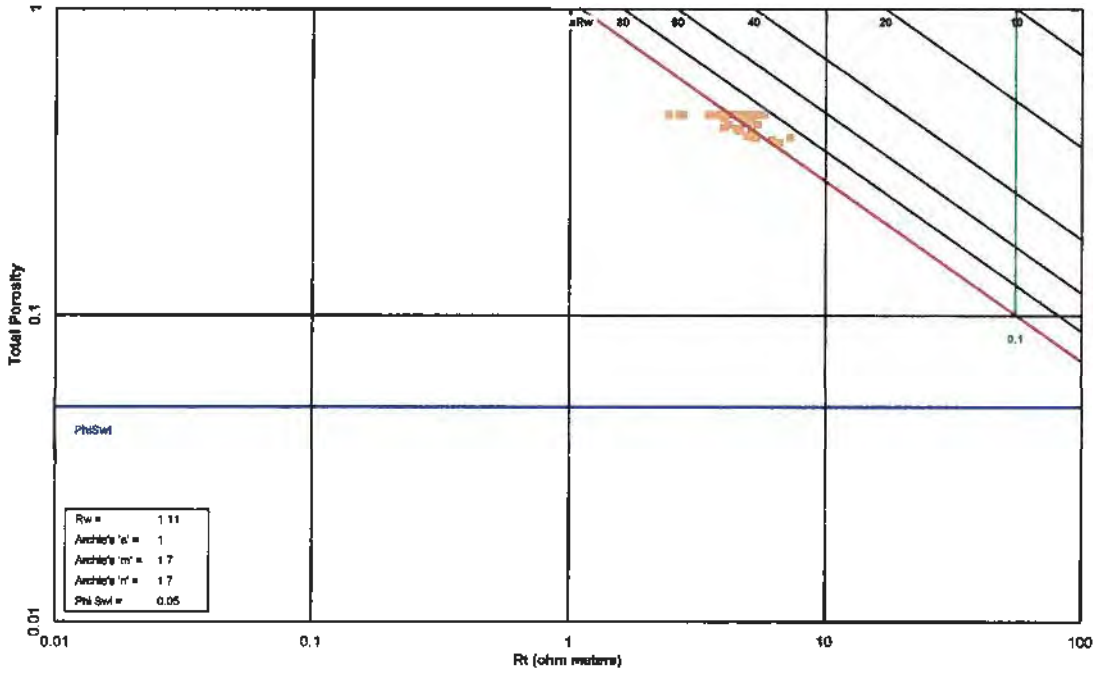
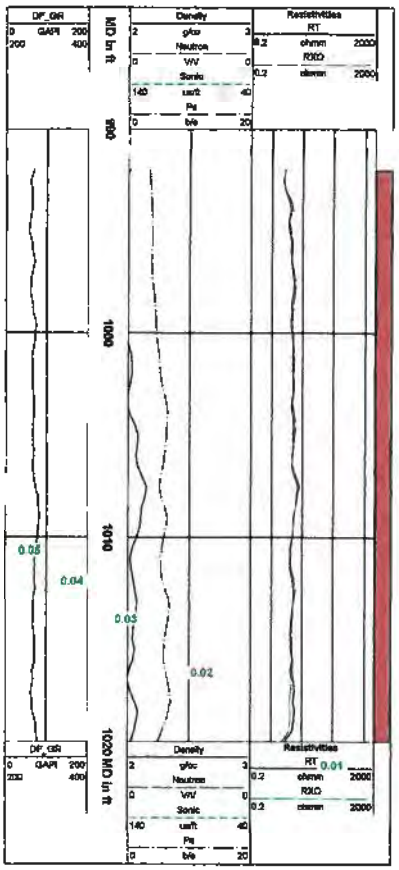
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
992-1020
Time: 08:35 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720685
UWI: Citizen_Green_1





T: 73°

R_w: 1.11 Salinity = 5000

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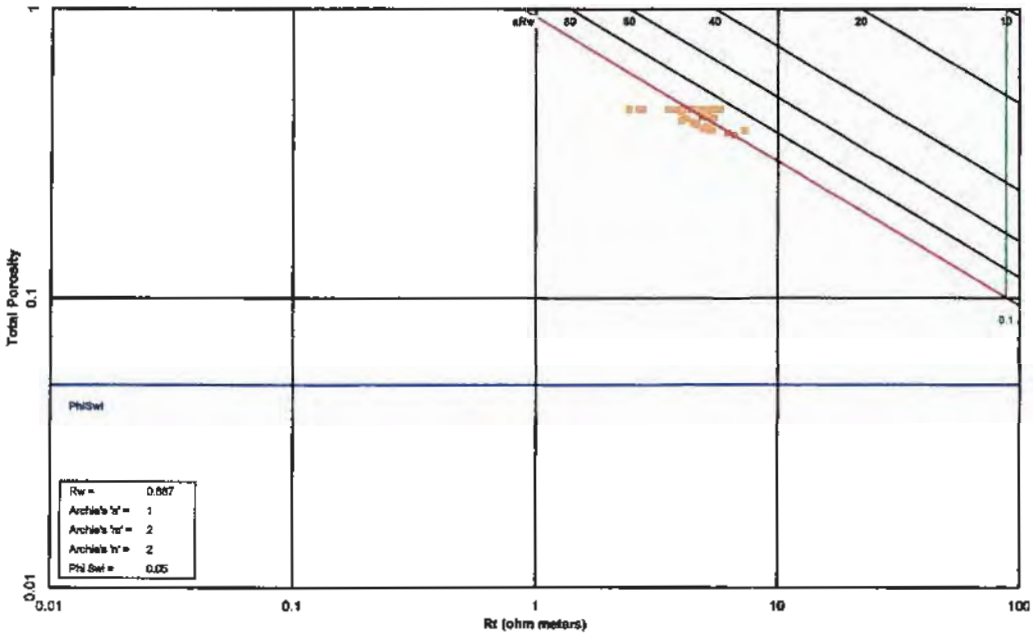
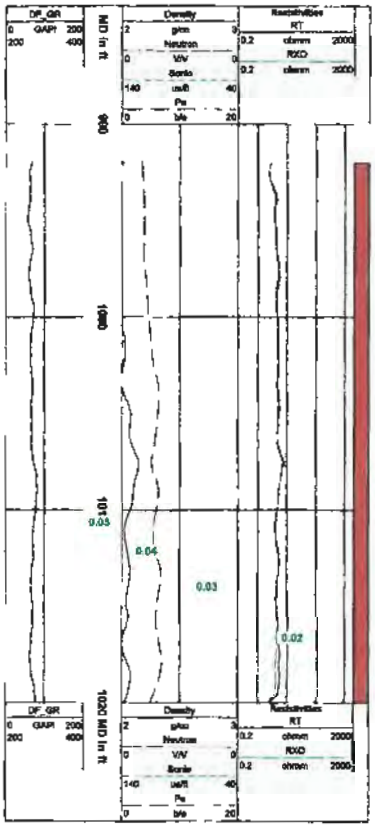
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
992-1020
Time: 03:38 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T = 73°

Rw = 0.687 Rw = 7000

DIGITAL FORMATION

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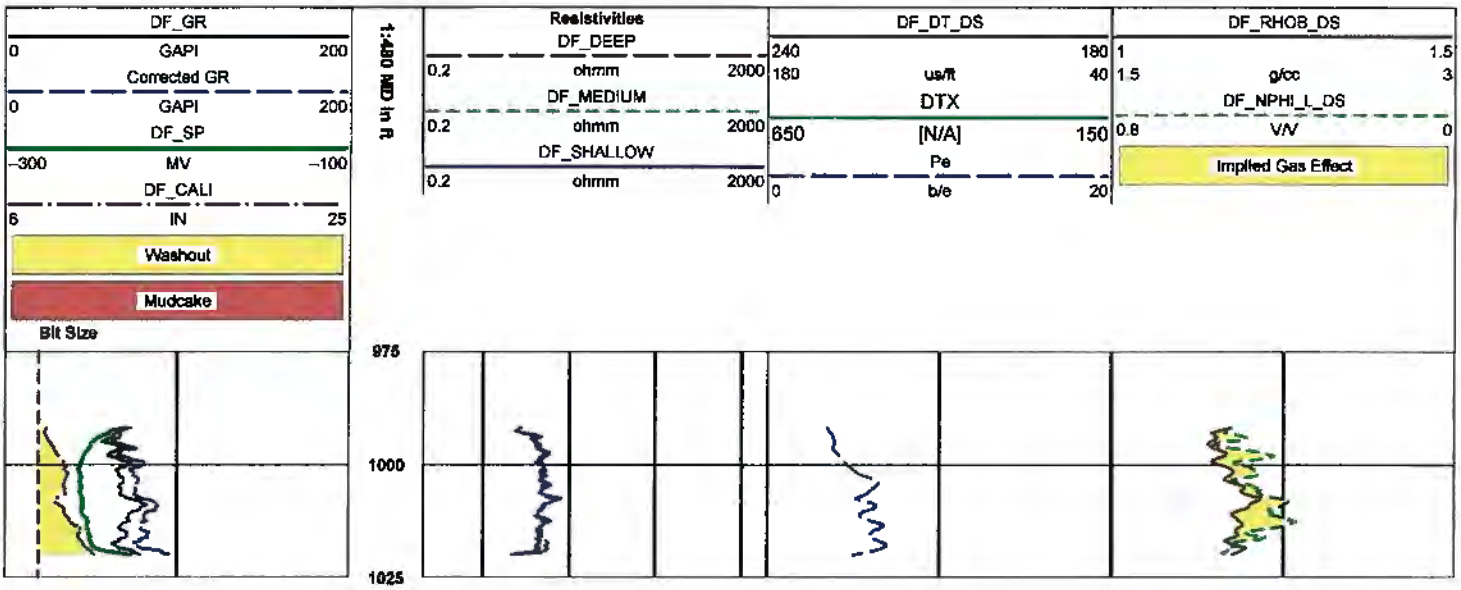
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
992-1020
Time: 03:37 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1

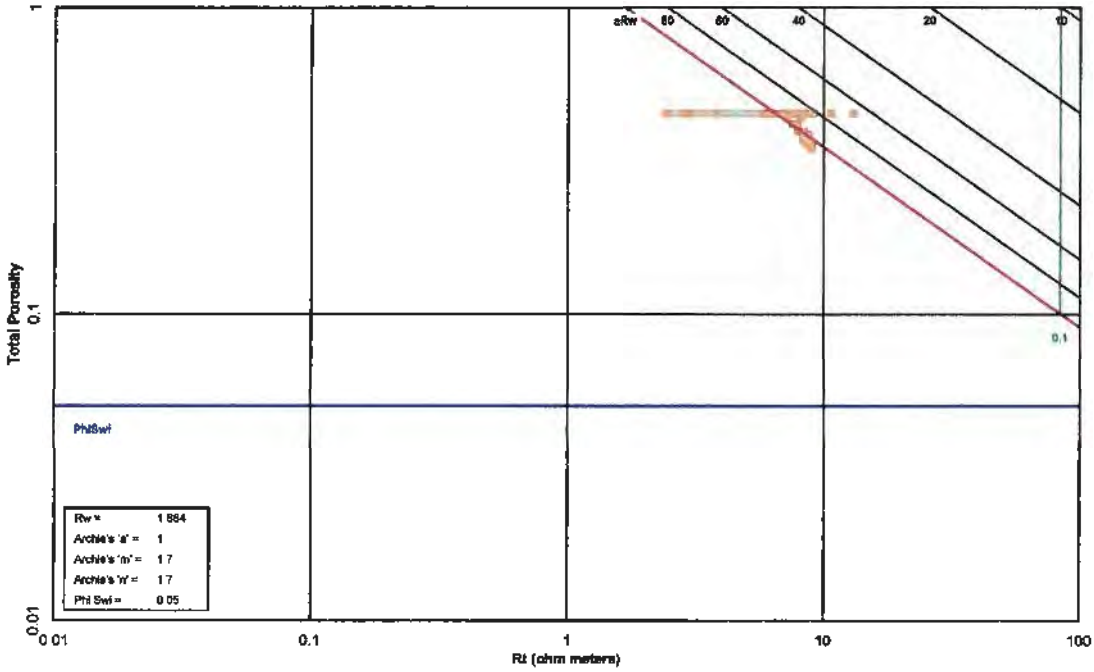


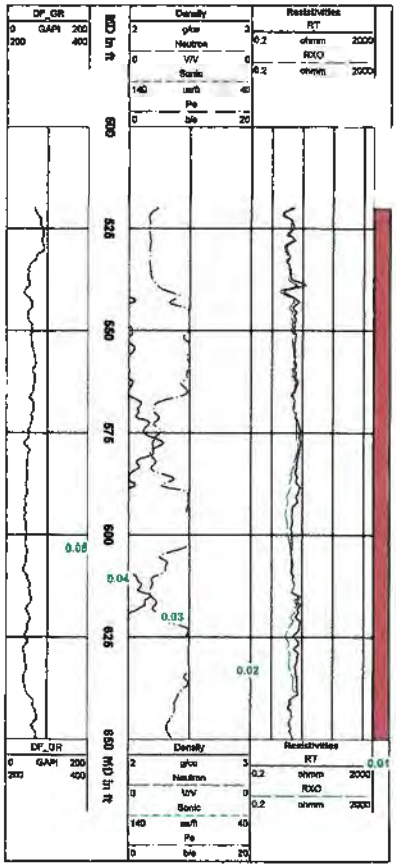
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.6 to 7575 by 0.5 F
Ranges: User Ranges
520-650
Time: 08:33 AM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Interactive Pickett Plot - Rw

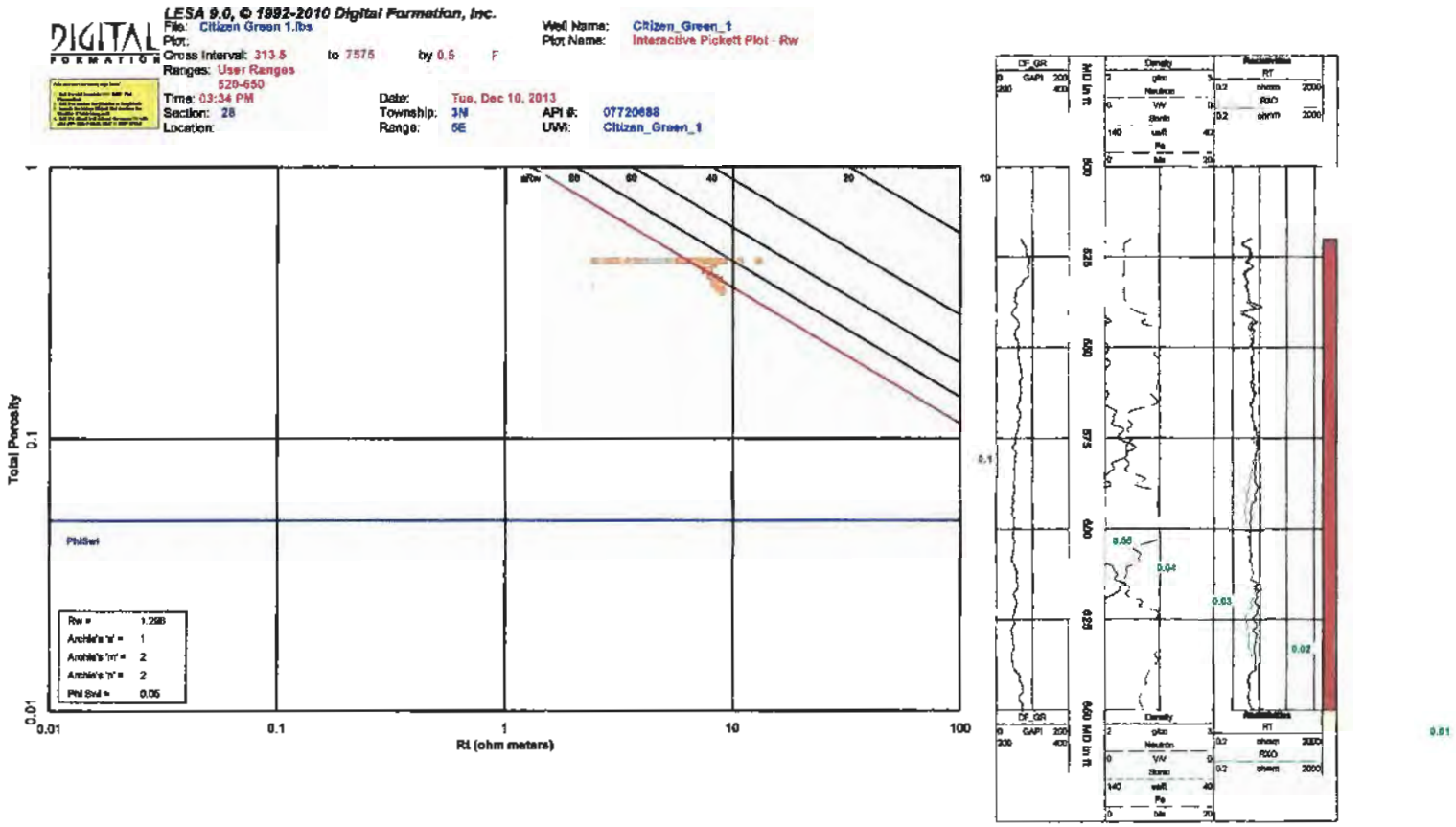
Date: Wed, Dec 11, 2013
Township: 3N
Range: 5E
API #: 07720688
UWI: Citizen_Green_1





T = 66.5

Rw: 1.684 Salmg 4000



T = 65°

Rw = 1.298 Salty Sand

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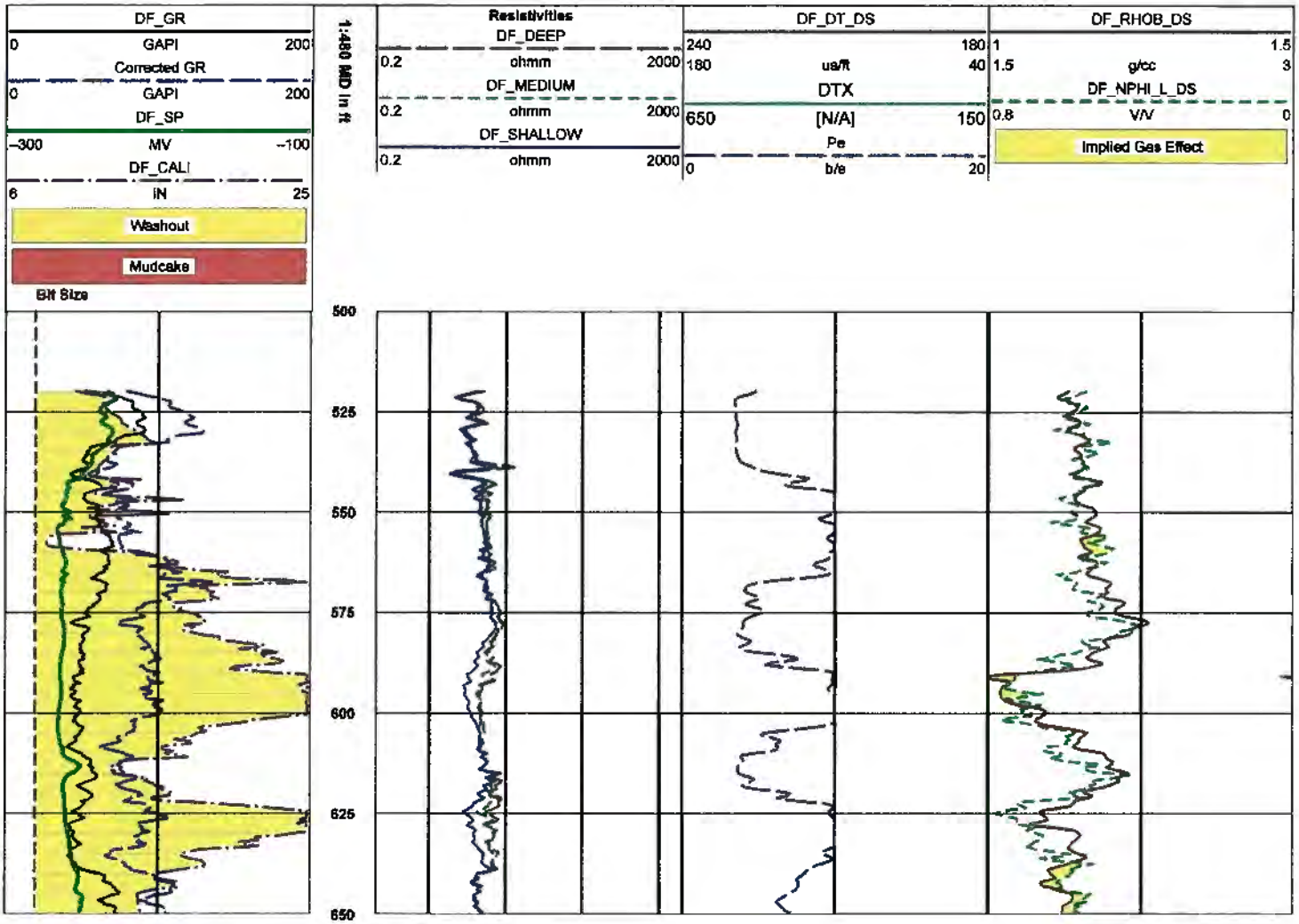
File: Citizen Green 1.lbs
Plot:
Gross Interval: 313.5 to 7575 by 0.5 F
Ranges: User Ranges
520-650
Time: 03:35 PM
Section: 28
Location:

Well Name: Citizen_Green_1
Plot Name: Raw Data Log (US and Canada)

Date: Tue, Dec 10, 2013
Township: 3N
Range: 5E

API #: 07720688
UWI: Citizen_Green_1



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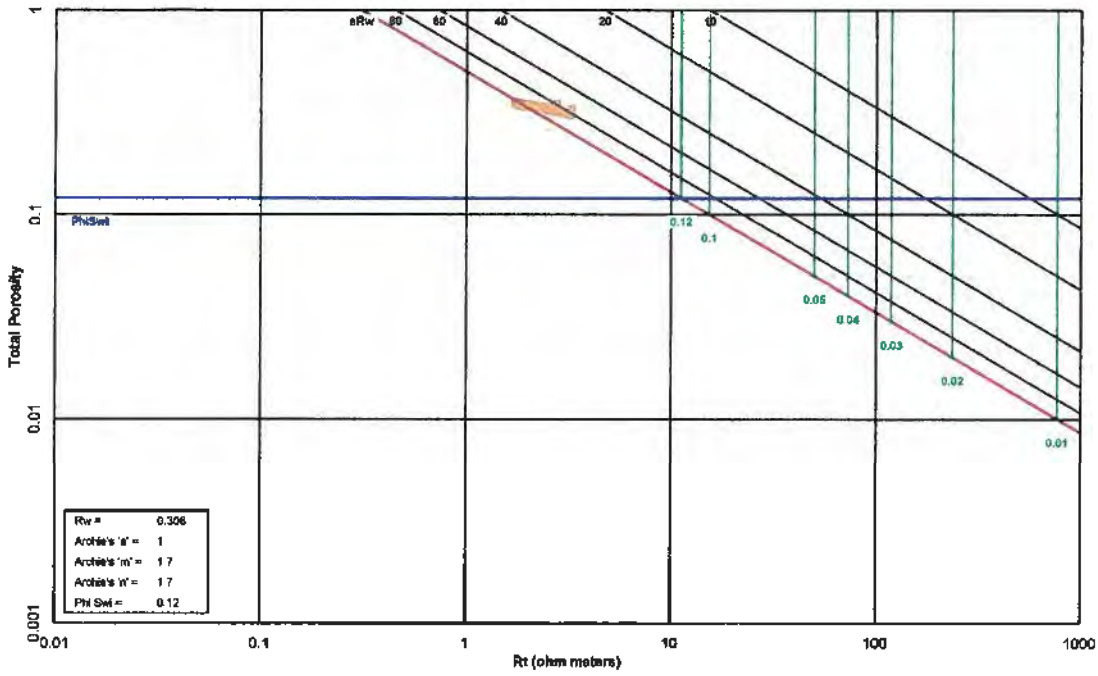
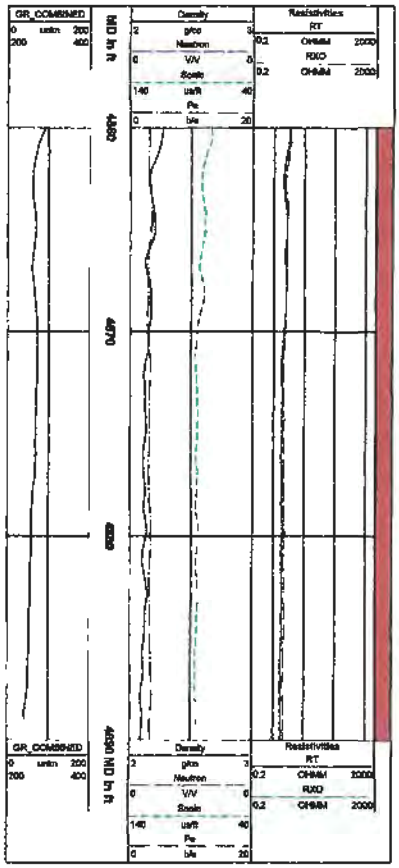
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4850-4890
Time: 02:31 PM
Section: 27
Location: LAT 38.06155572

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

API #: 04-077-20736
UWI: 04-077-20736





Temp 123

R_w = 0.308 5.5g 12,000

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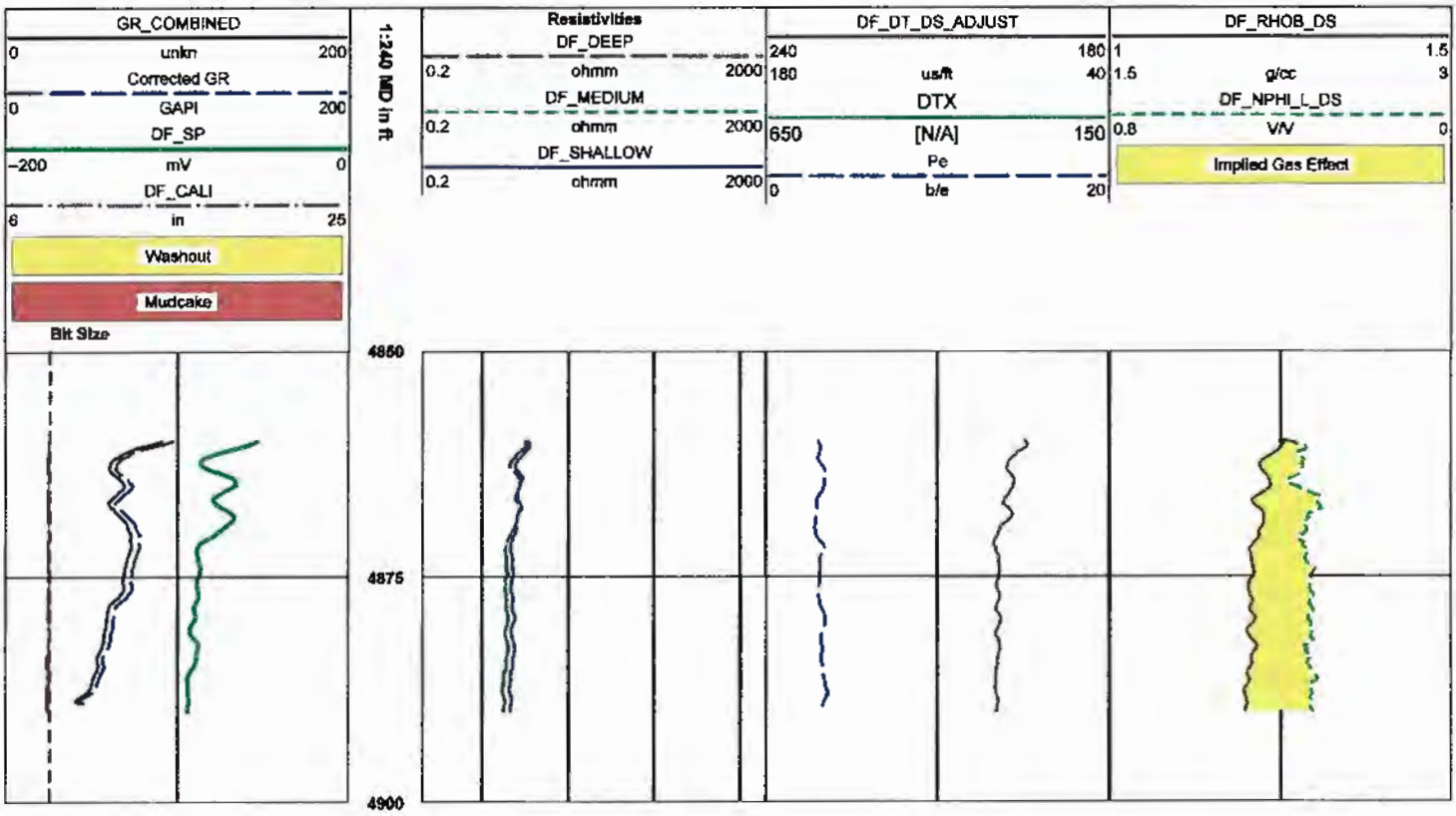
File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4860-4890
Time: 02:31 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



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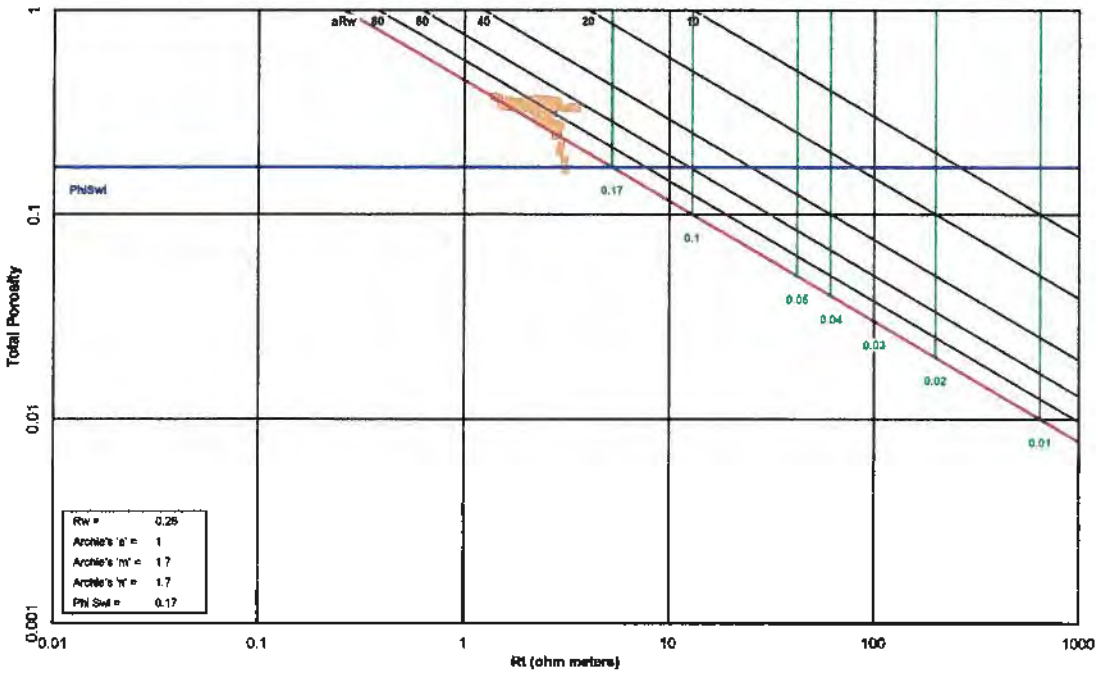
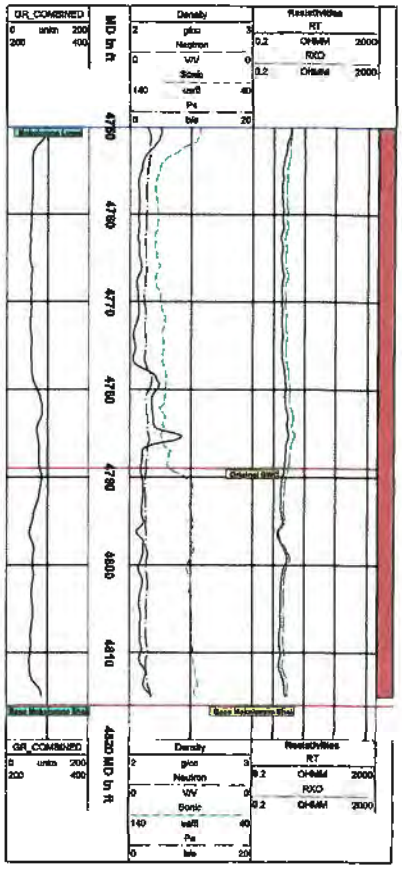
DIGITAL FORMATION

File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4750-4815
Time: 02:29 PM
Section: 27
Location: LAT 38.08155572

Well Name: PlACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 122

Rw: 0.26 Salnty 14500

DIGITAL FORMATION

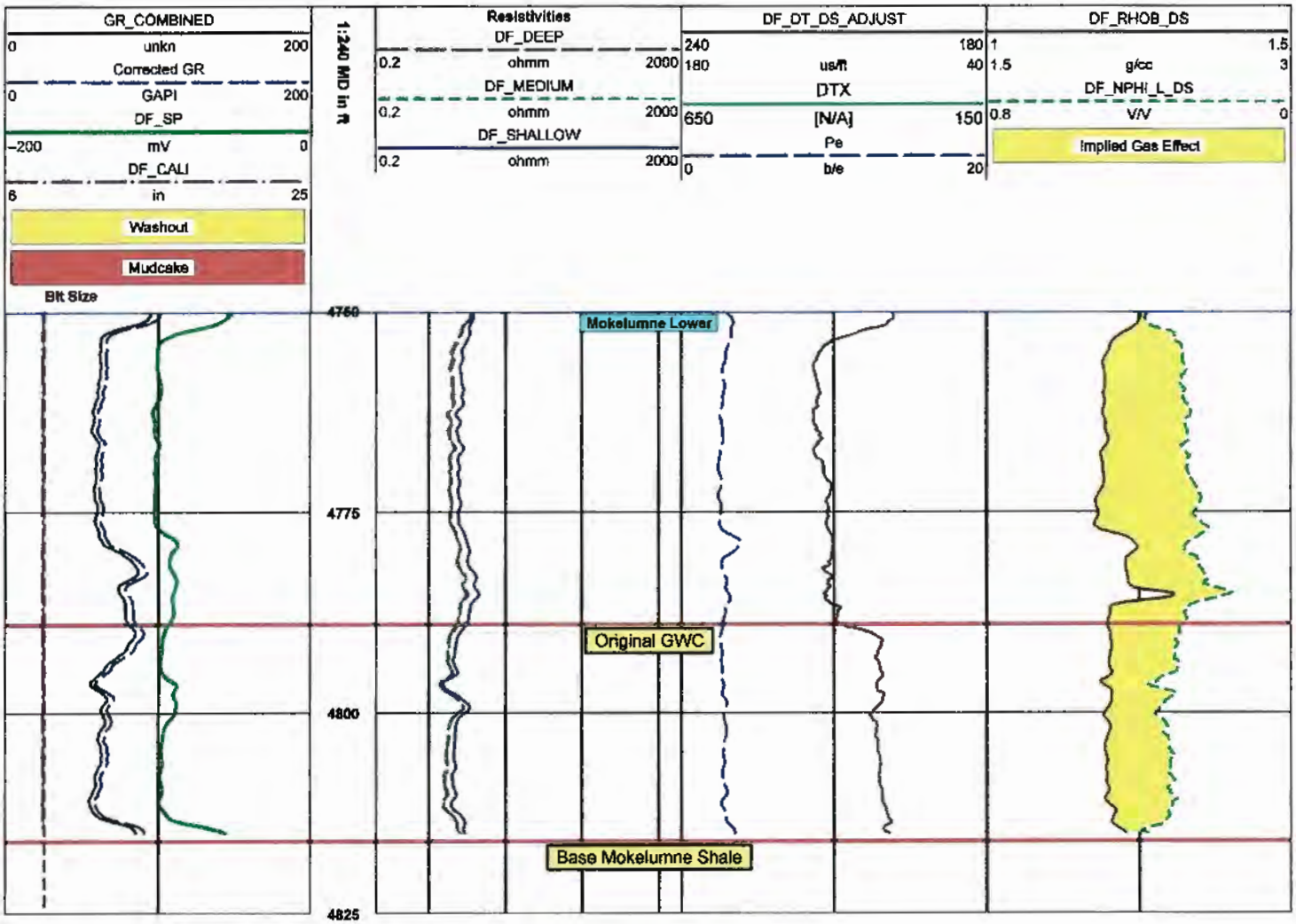
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4750-4815
Time: 02:28 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

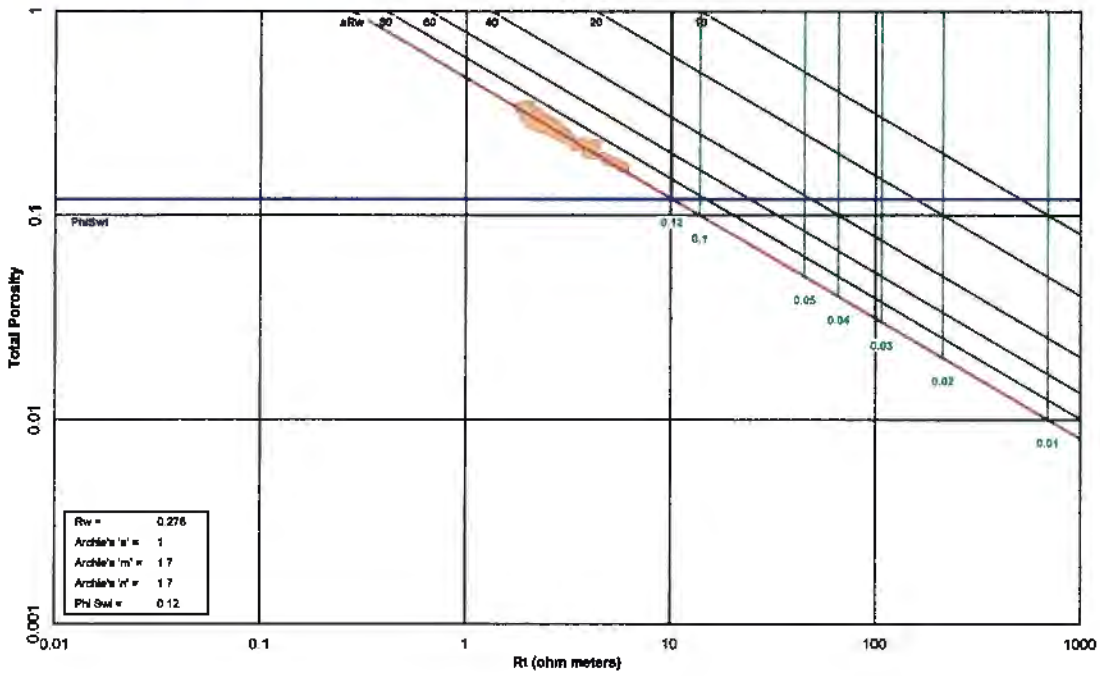
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

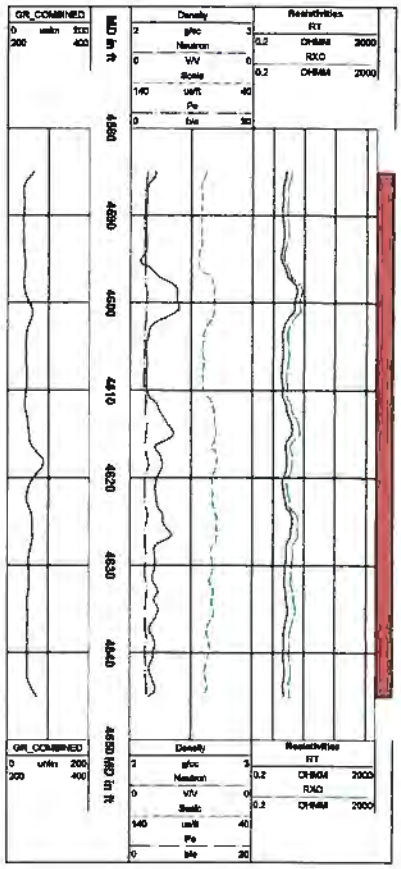
API #: 04-077-20736
UWI: 04-077-20736



LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4585-4645
Time: 02:26 PM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 120

Rw: 0.276 Salinity 13500

DIGITAL FORMATION

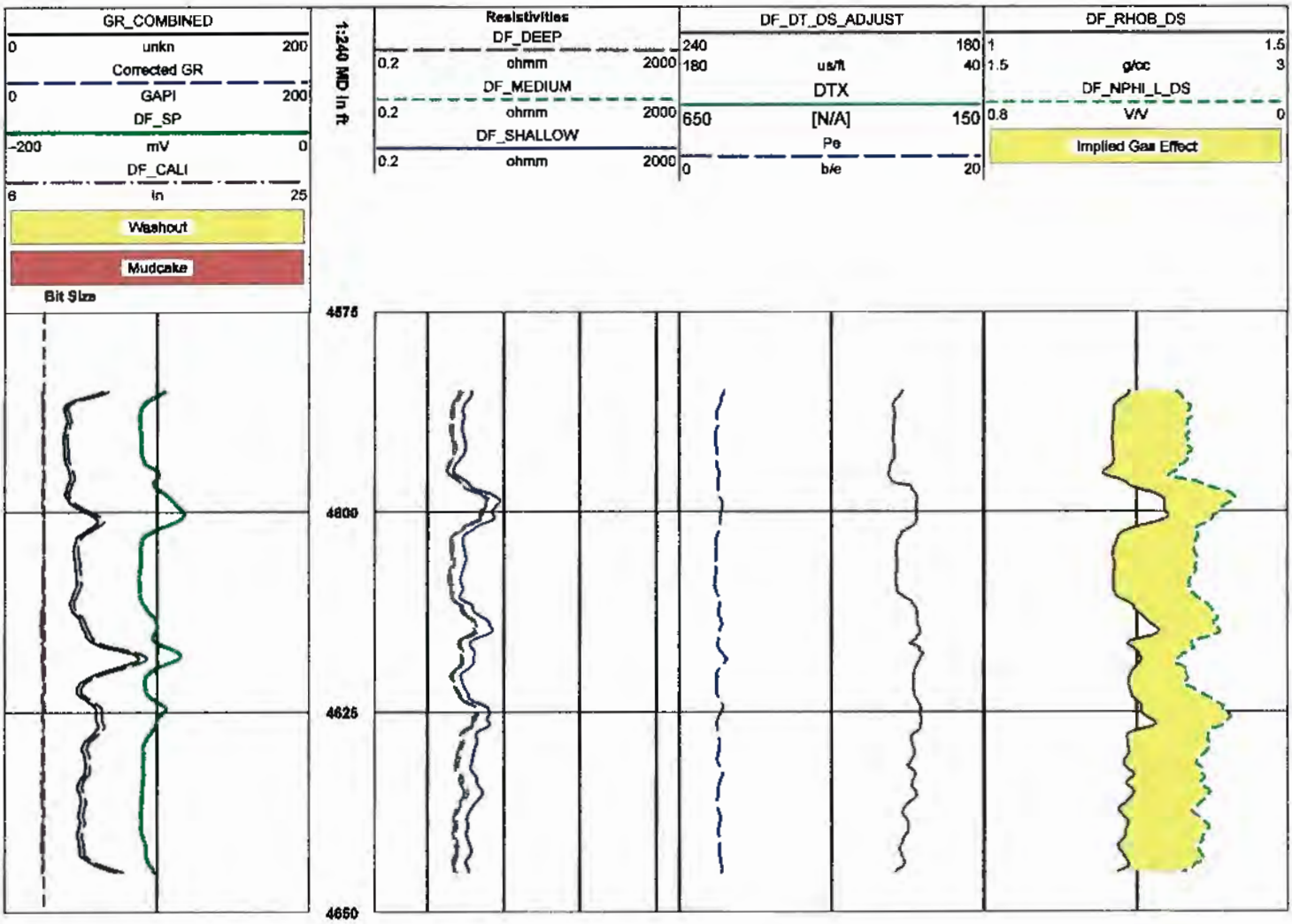
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4585-4645
Time: 02:26 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736

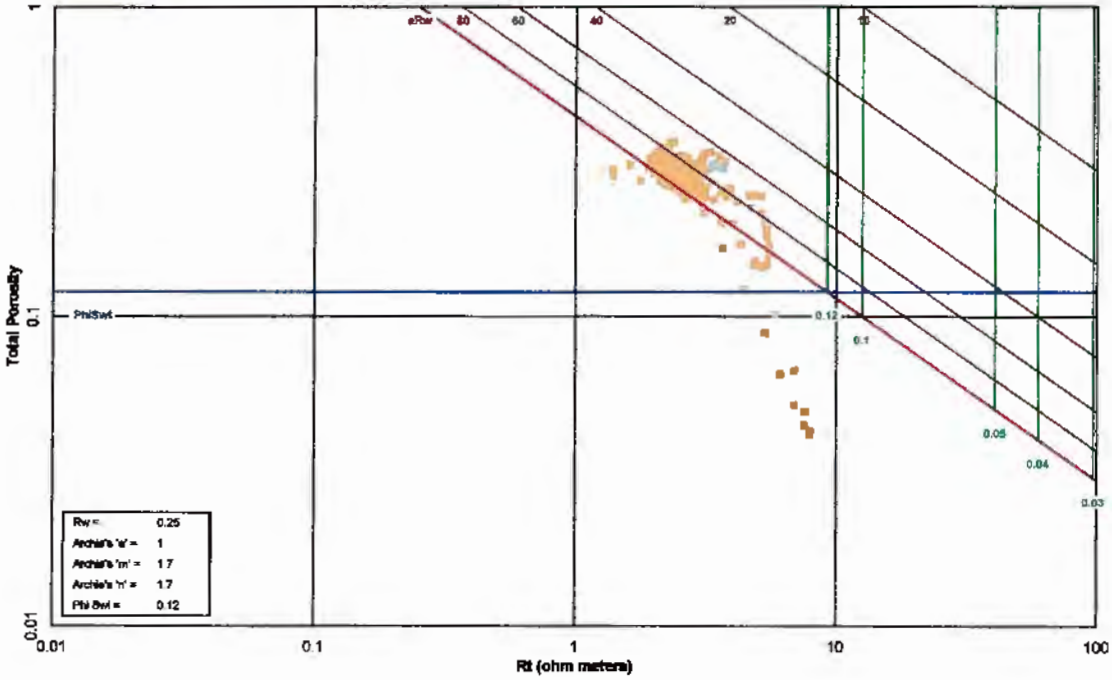


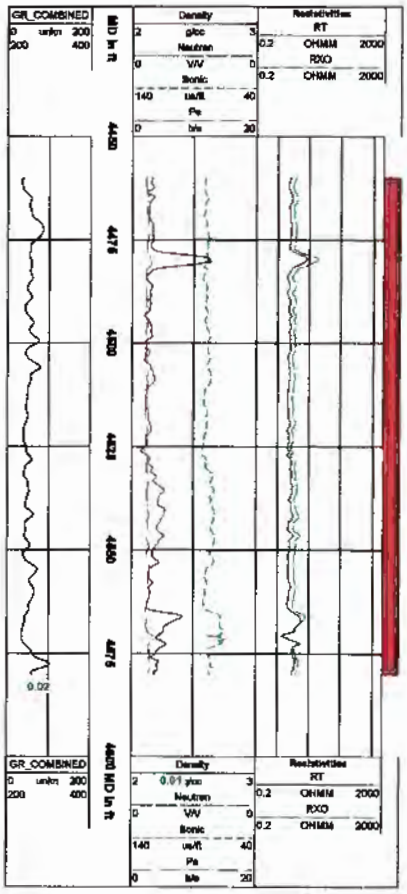
DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.ibs
Plot:
Gross Interval: 560 to 4983 by 0.25 F
Ranges: User Ranges
4460-4560
Time: 11:14 AM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N
Range: 8E
API #: 04-077-20736
UWI: 04-077-20736





Temp 119

Rw 0.25 Temp 17000

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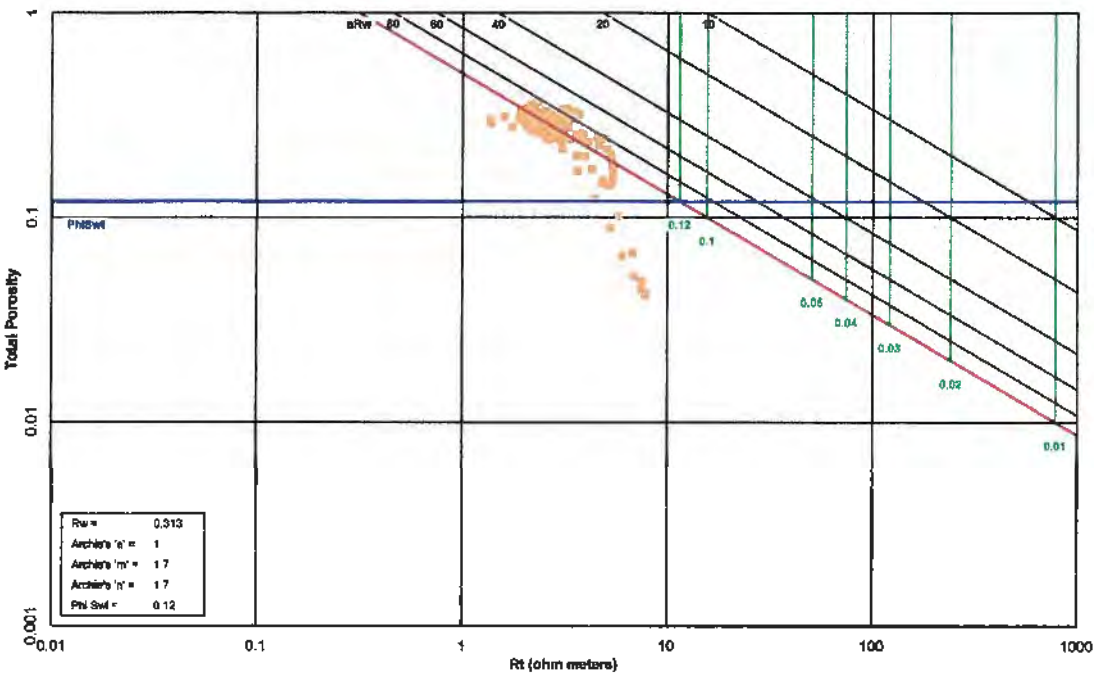
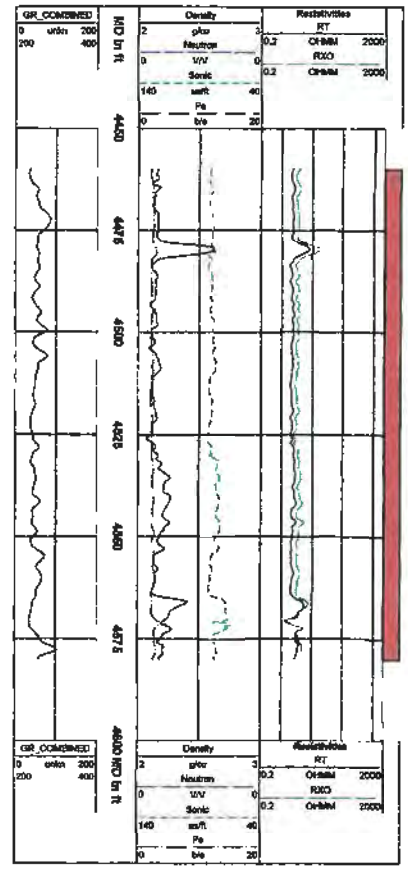
File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4450-4580
Time: 02:23 PM
Section: 27
Location: LAT 38.06155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 119

Rw 0.313 Salinity 12,000

DIGITAL FORMATION

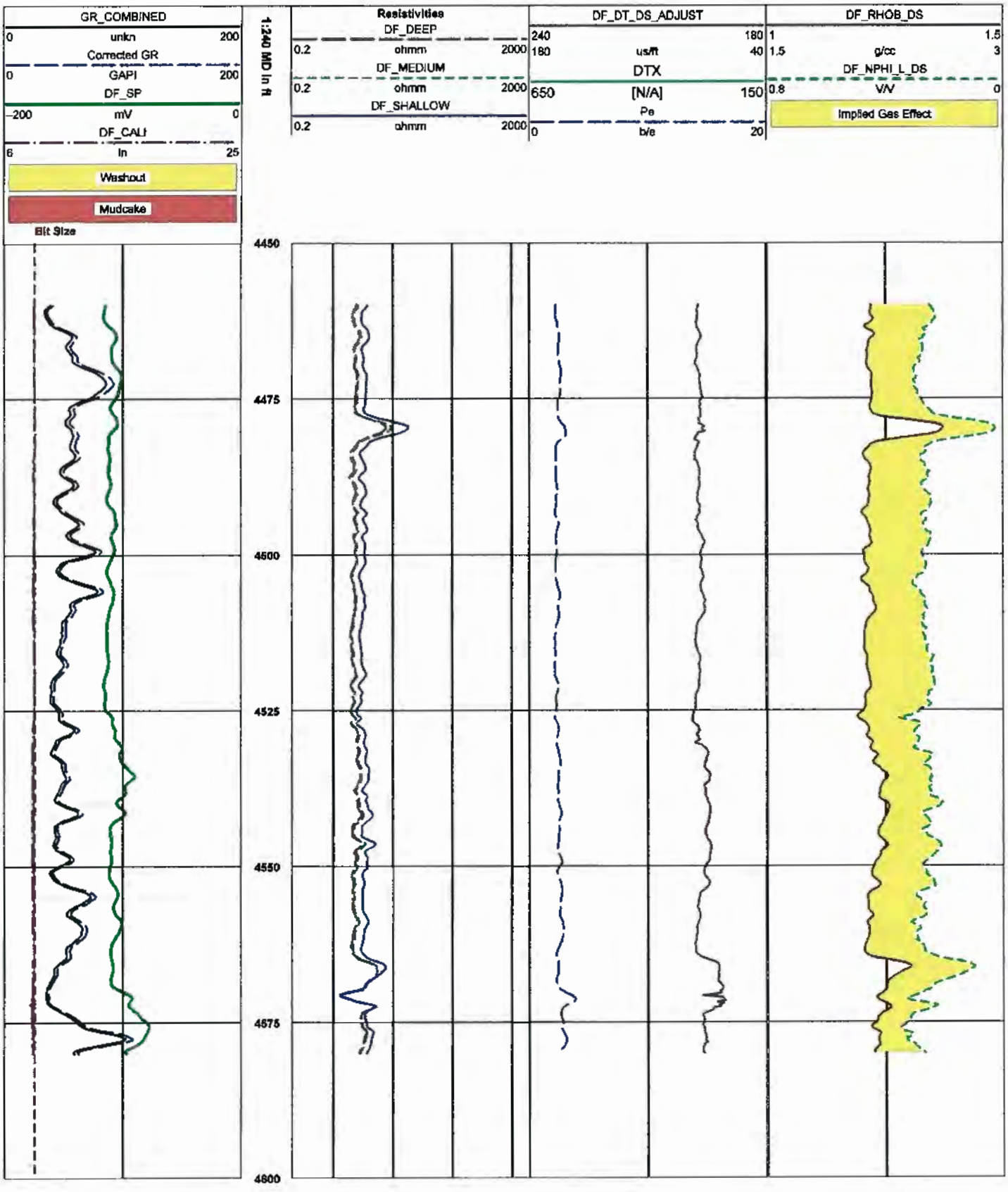
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4460-4580
Time: 02:24 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736

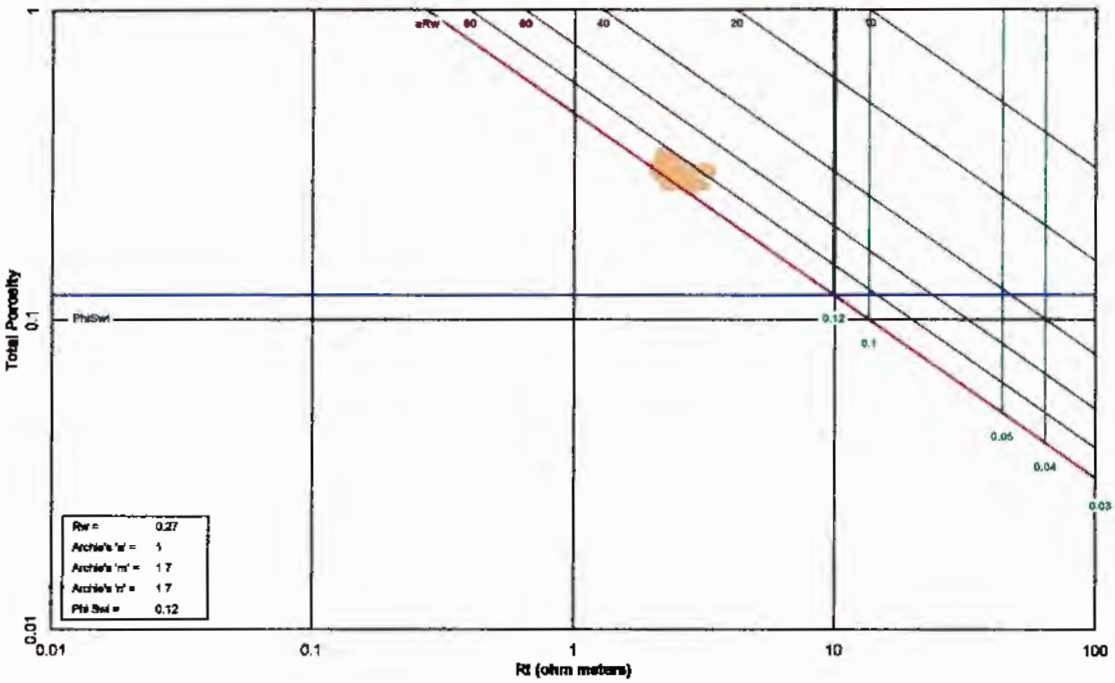


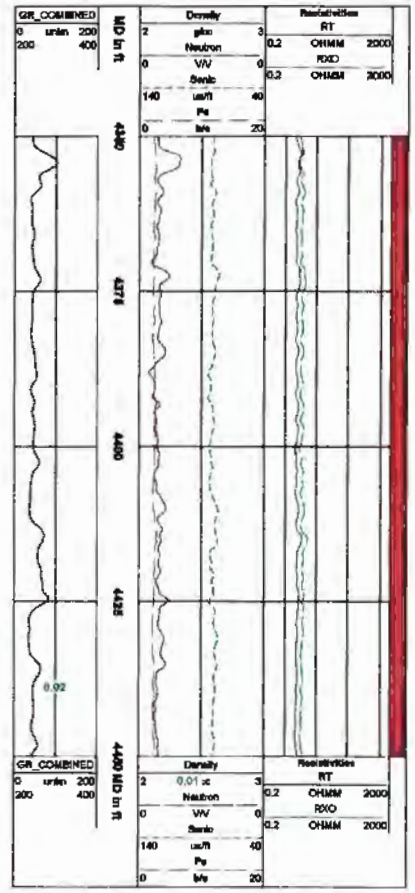
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Placentine 2-27.lbs
Plot:
Gross Interval: 560 to 4983 by 0.25 F
Ranges: User Ranges 4350-4450
Time: 11:12 AM
Section: 27
Location: LAT 38.08166672

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





T 118

Rw 0.27 Salty 15000

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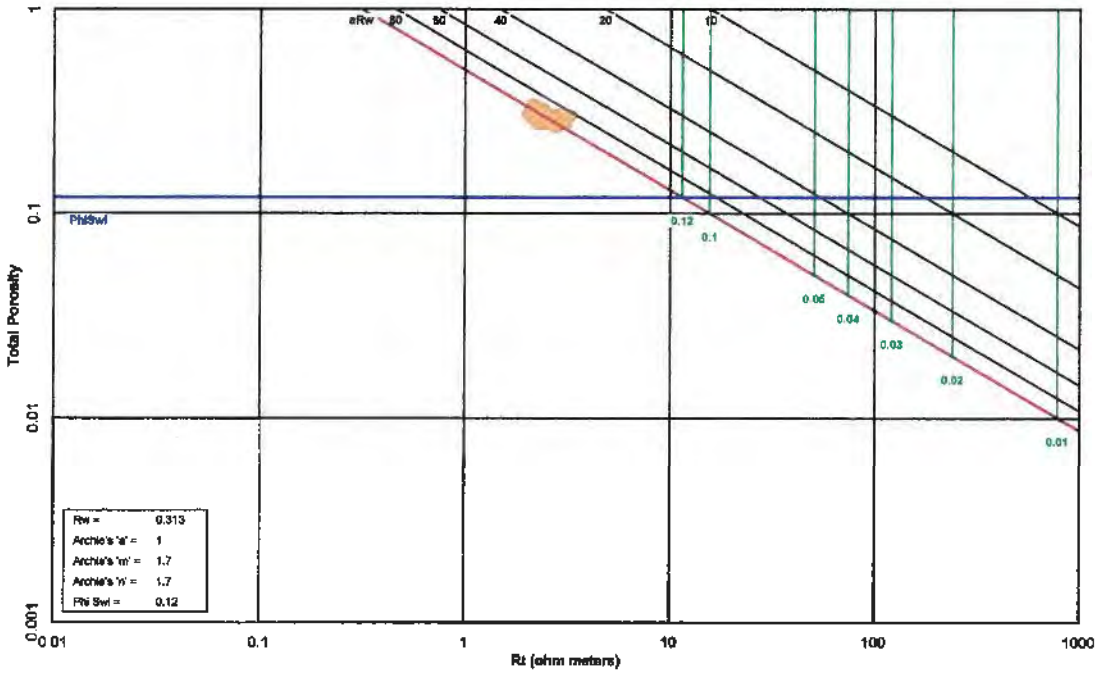
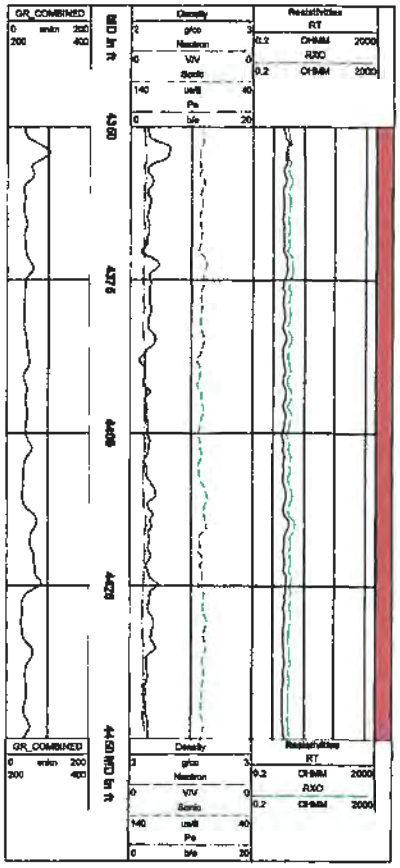
DIGITAL FORMATION

File: Placentine 2-27.ibs
Plot:
Gross Interval: 550 to 4953 by 0.25 F
Ranges: User Ranges
4350-4450
Time: 02:21 PM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 118

Rw ≈ 0.313 Salinity 12000

DIGITAL FORMATION

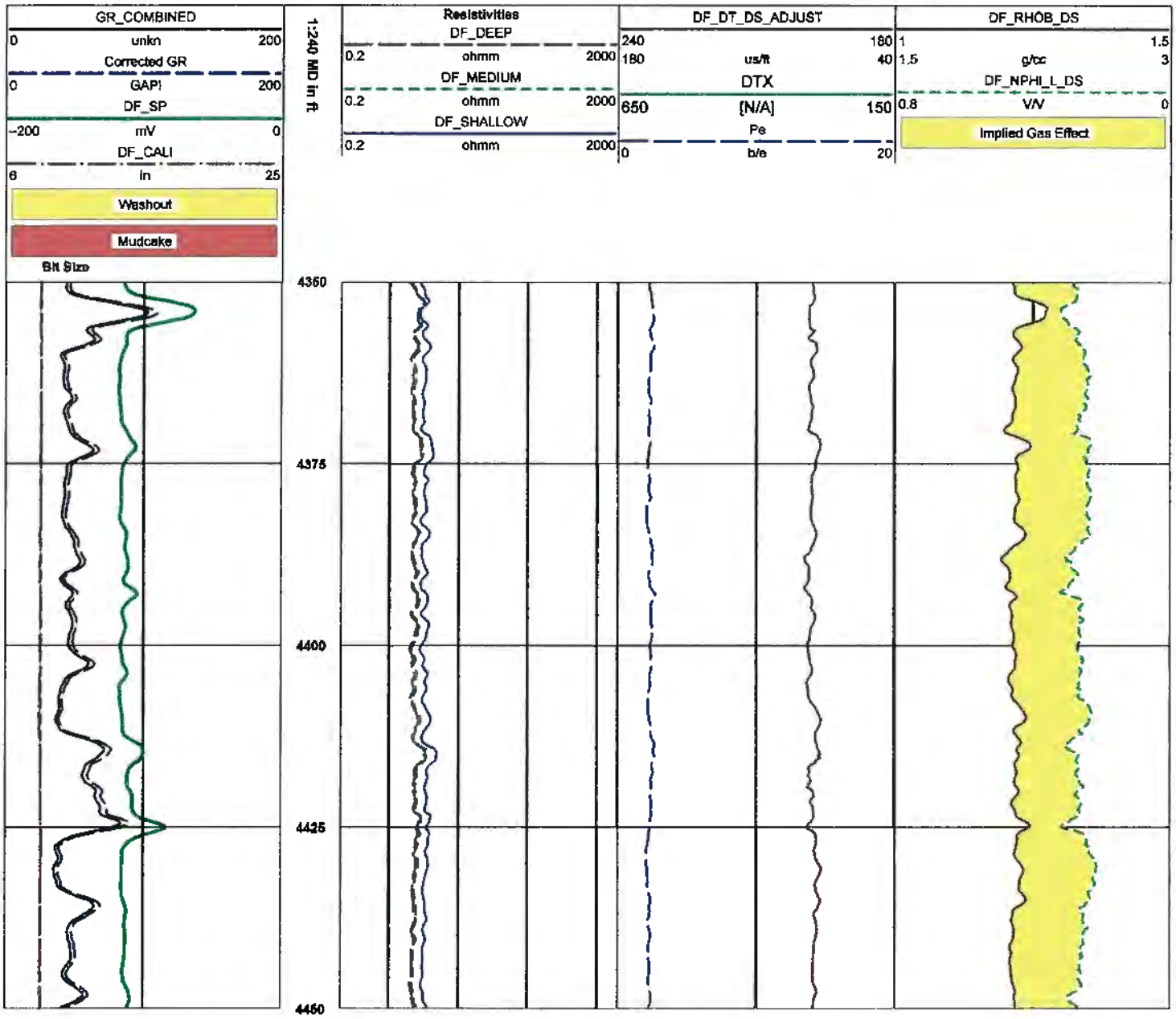
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4350-4450
Time: 02:21 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



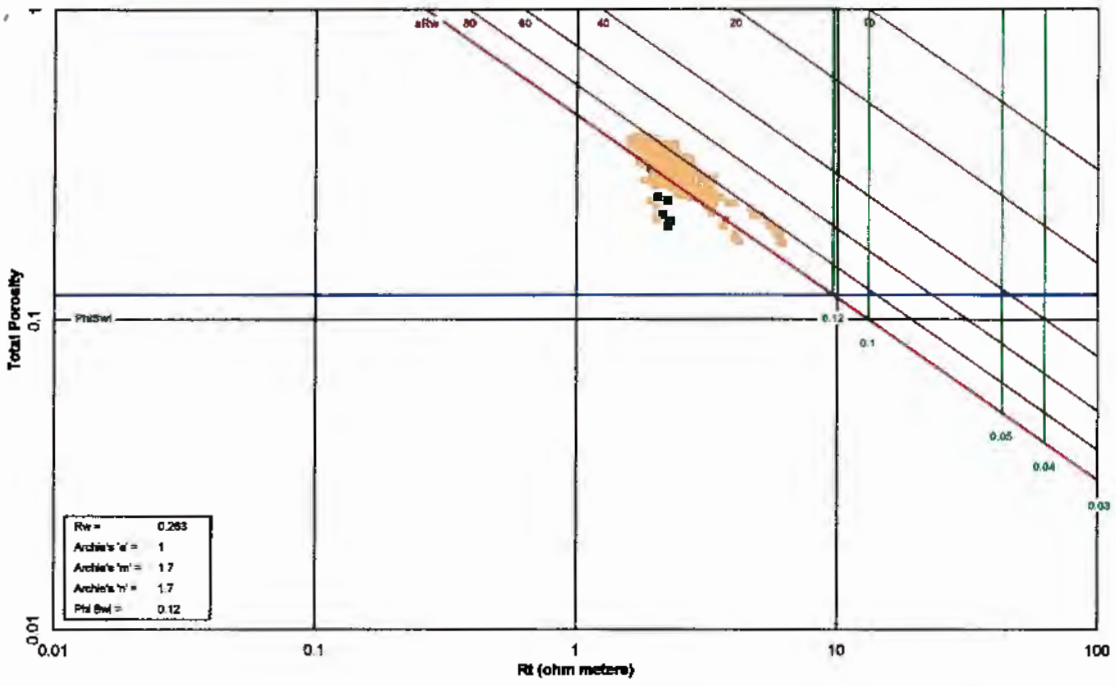
DIGITAL FORMATION

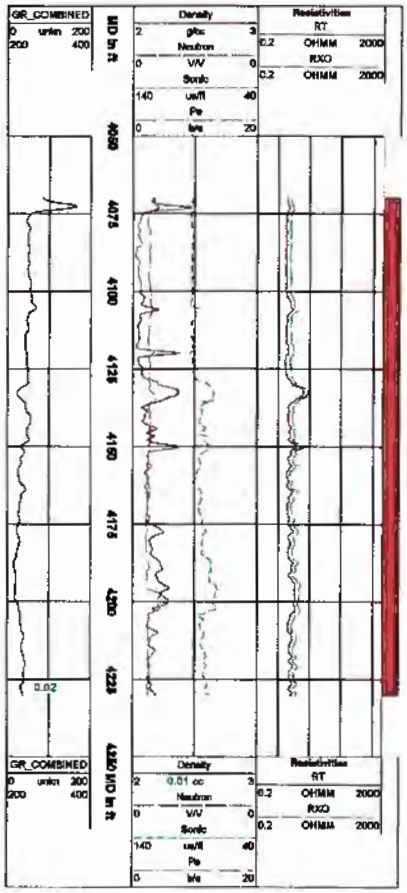
LESA 8.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.lbs
Plot:
Gross Interval: 650 to 4983 by 0.25 F
Ranges: User Ranges
4070-4230
Time: 11:09 AM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Sat, Dec 14, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736





T= 115

R_w 0263 Salt 16000

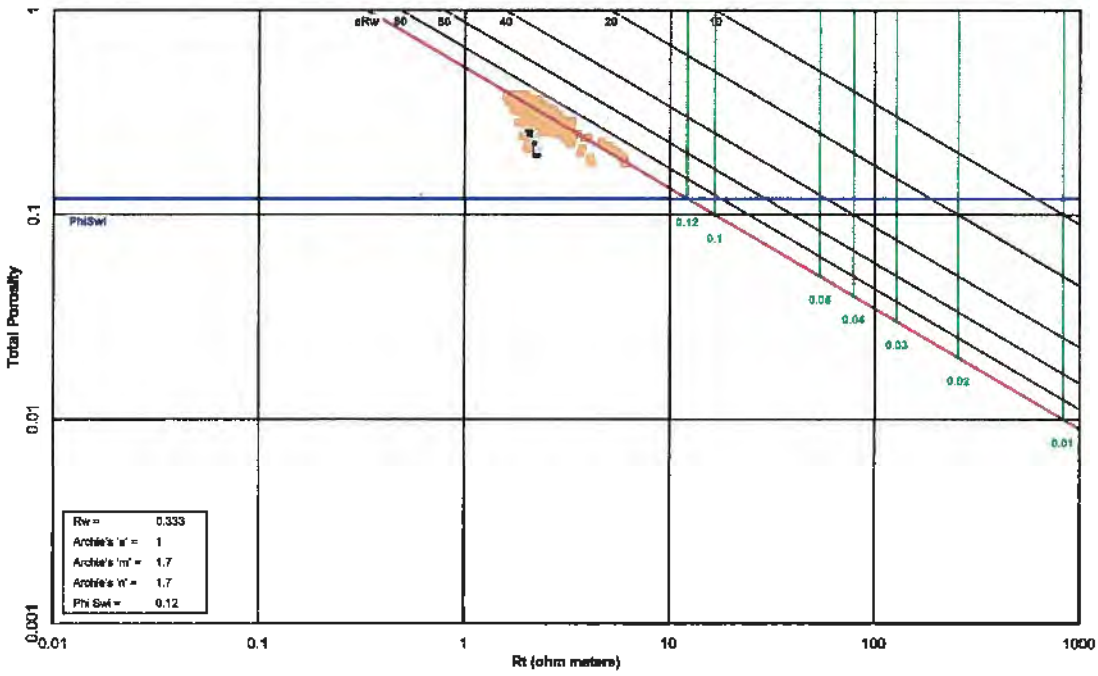
LESA 9.0, © 1992-2010 Digital Formation, Inc.

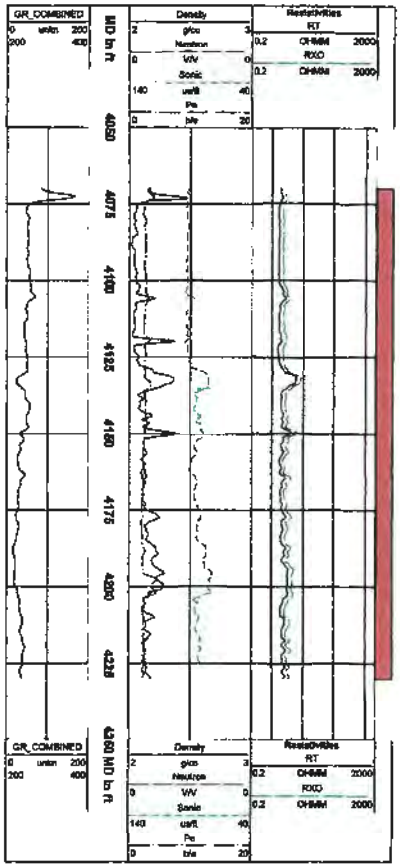
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4070-4230
Time: 02:15 PM
Section: 27
Location: LAT 38.08155572

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

API #: 04-077-20736
UWI: 04-077-20736





Temp 115

Rw 0.333 Salinity 11500

DIGITAL FORMATION

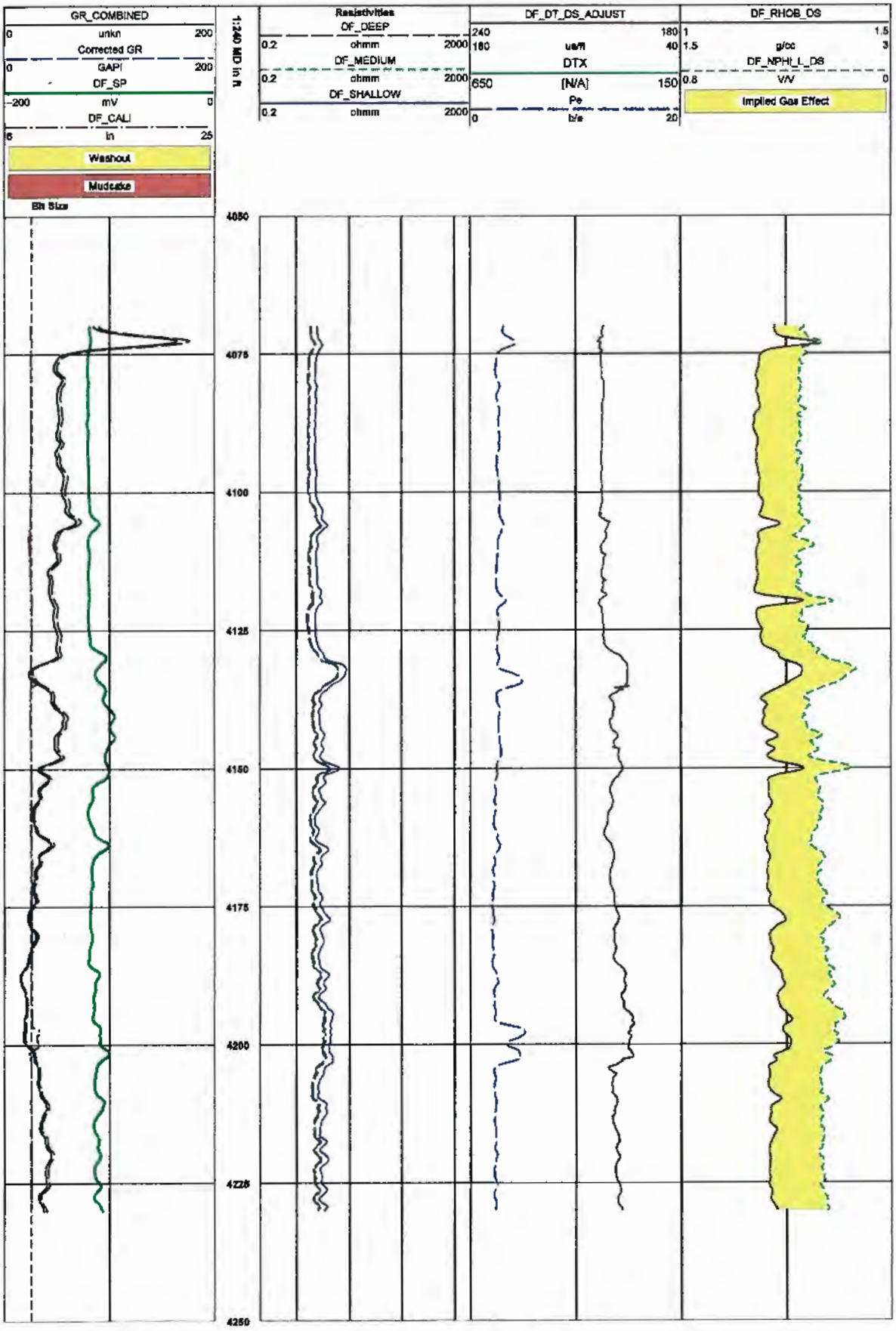
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
4070-4230
Time: 02:15 PM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



DIGITAL FORMATION

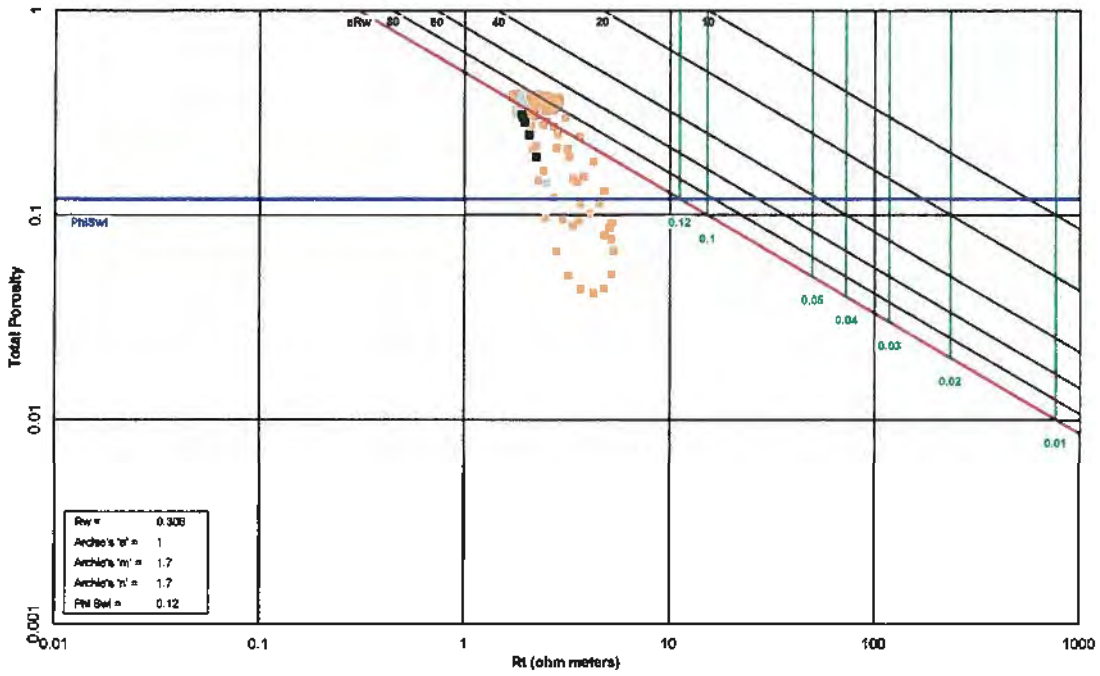
LESA 9.0, © 1992-2010 Digital Formation, Inc.

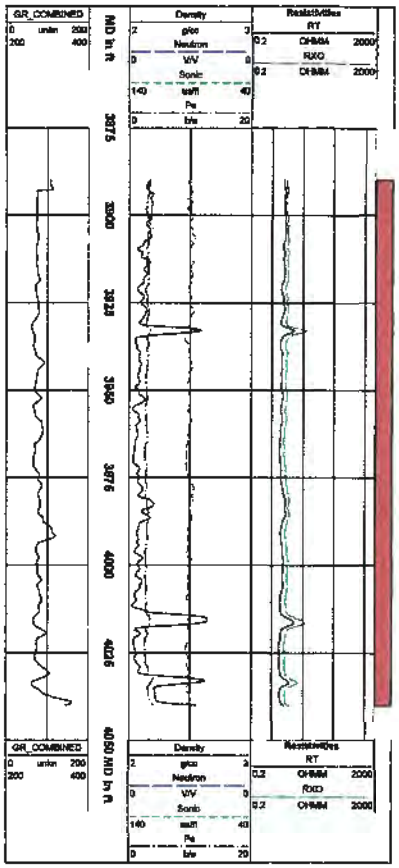
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3890-4040
Time: 02:13 PM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736





Temp 112

Rw 0,306 Salinity 13500

DIGITAL FORMATION

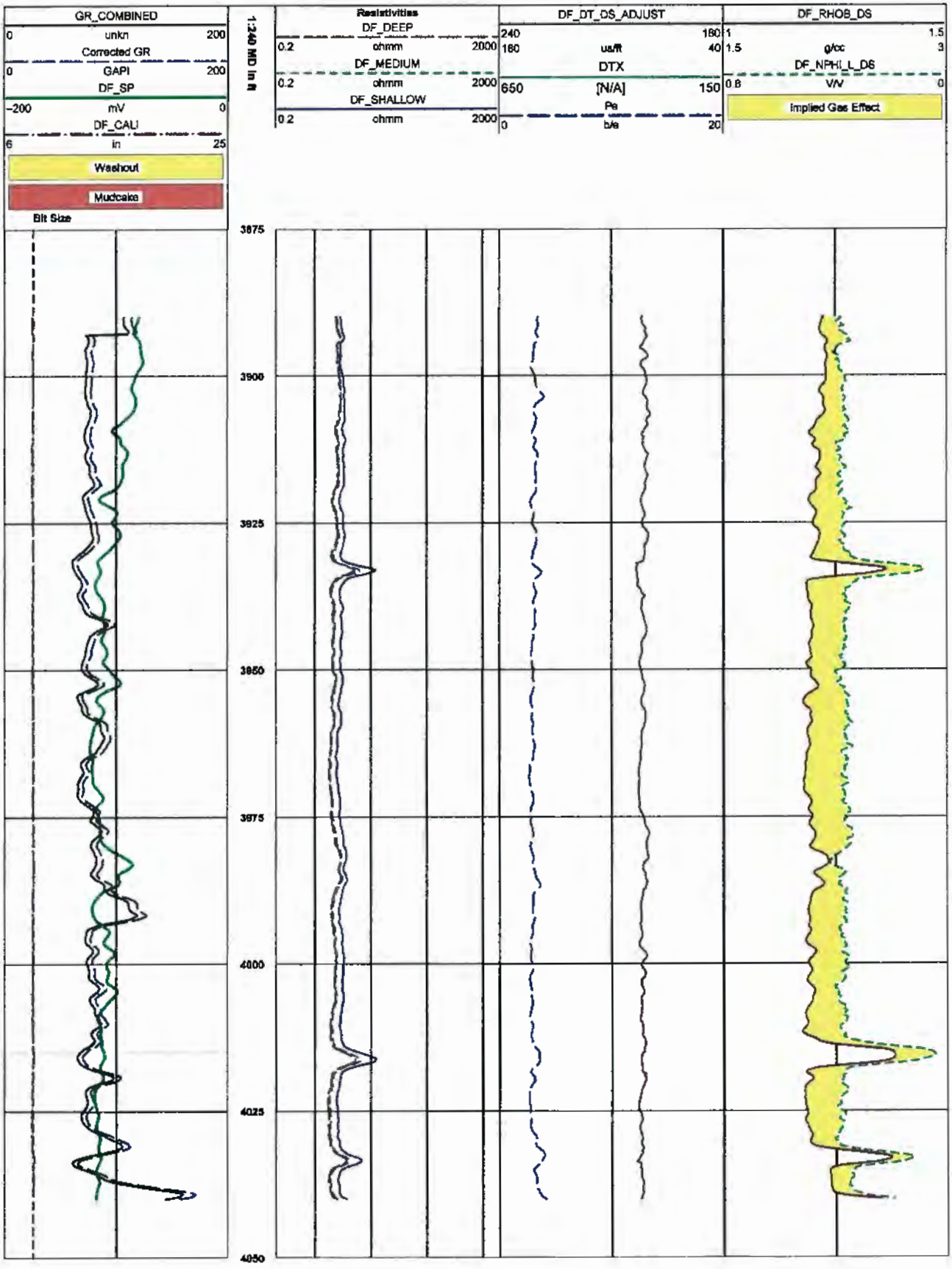
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3890-4040
Time: 02:13 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736

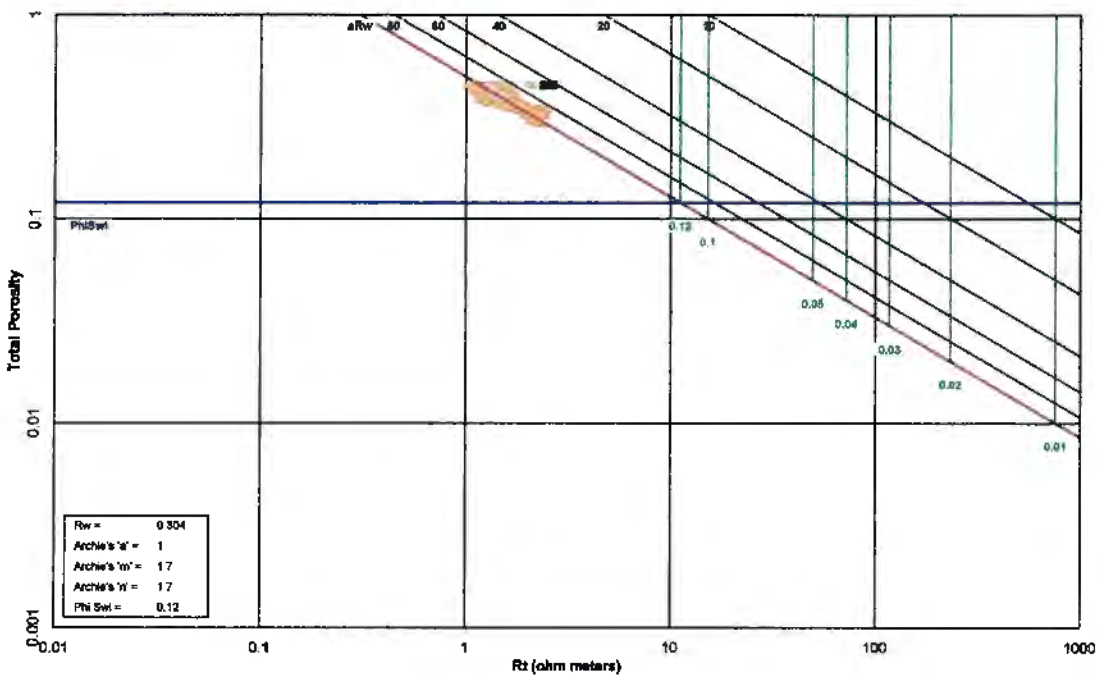


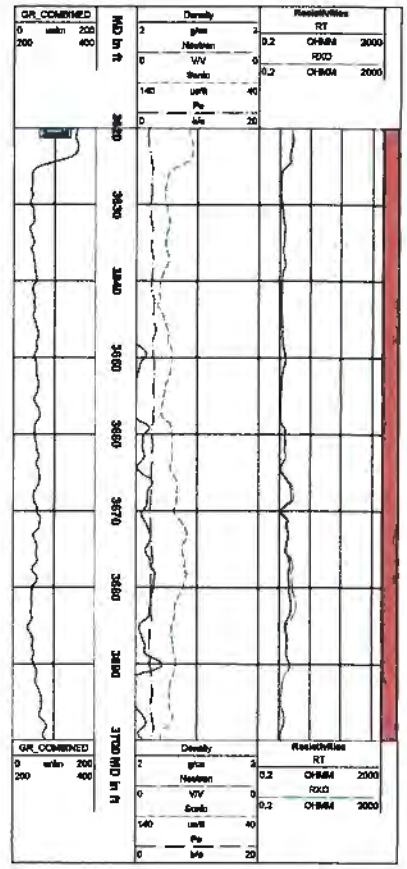
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges 3620-3700
Time: 01:51 PM
Section: 27
Location: LAT 38.08156572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20738
UWI: 04-077-20738





Temp 108

Rw = 0.304 Saling 14,000

DIGITAL FORMATION

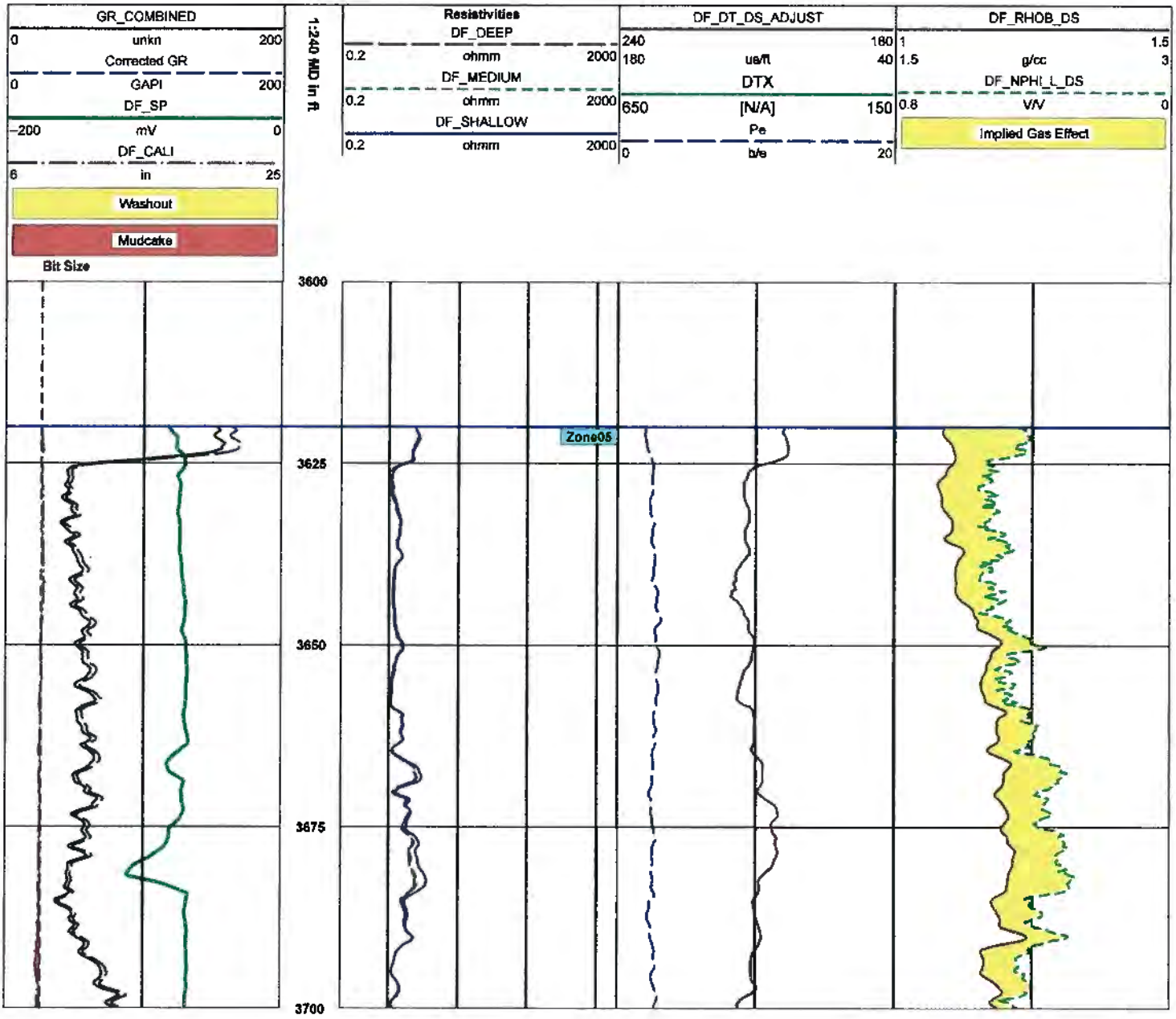
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3620-3700
Time: 01:52 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

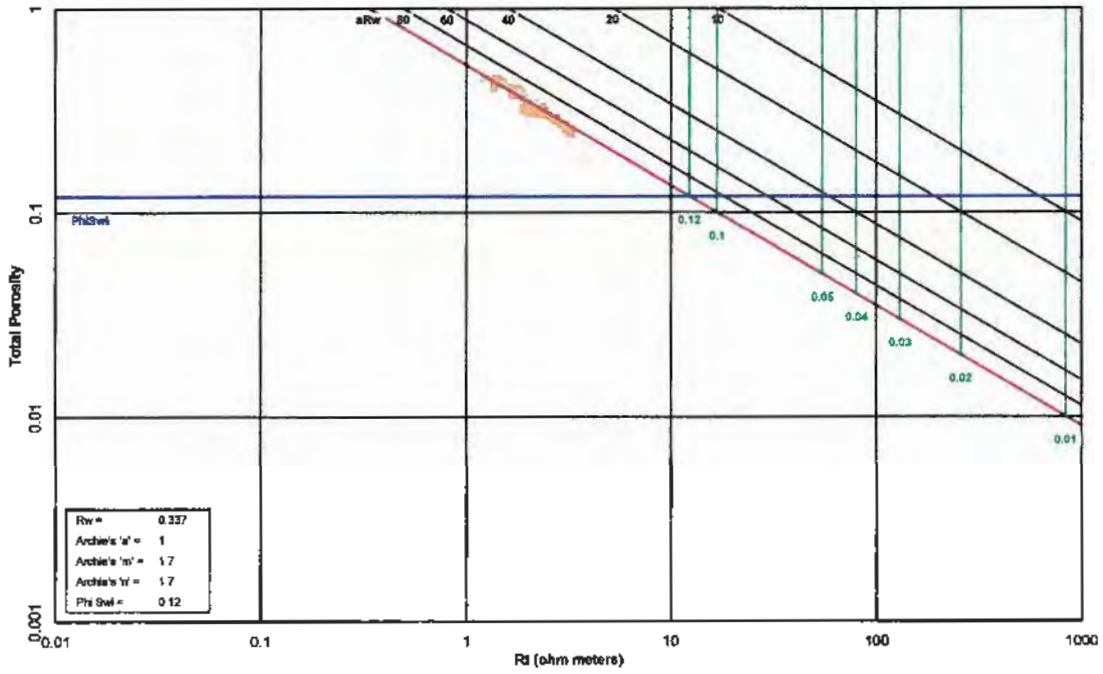
API #: 04-077-20736
UWI: 04-077-20736

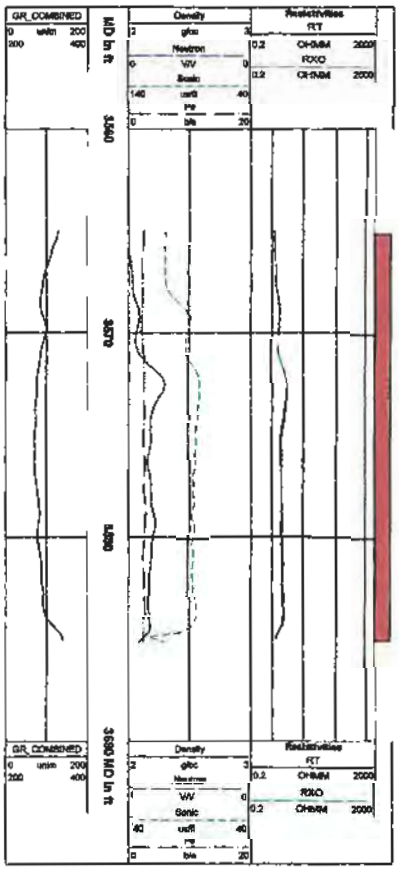


LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Piacentine 2-27.fbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3565-3585
Time: 01:34 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 106

Rw 0.337 Salinity 13000

DIGITAL FORMATION

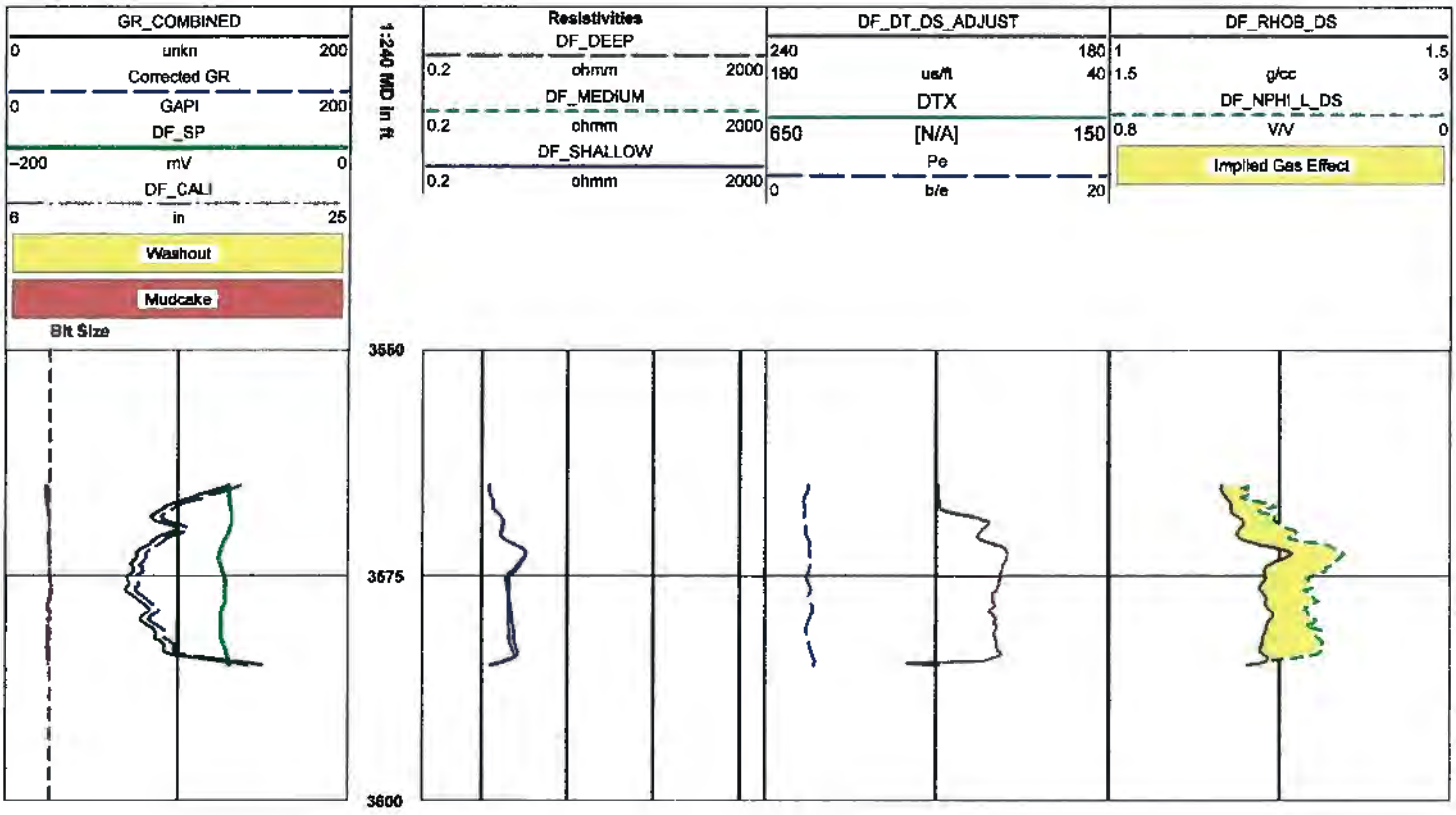
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3565-3585
Time: 01:33 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736

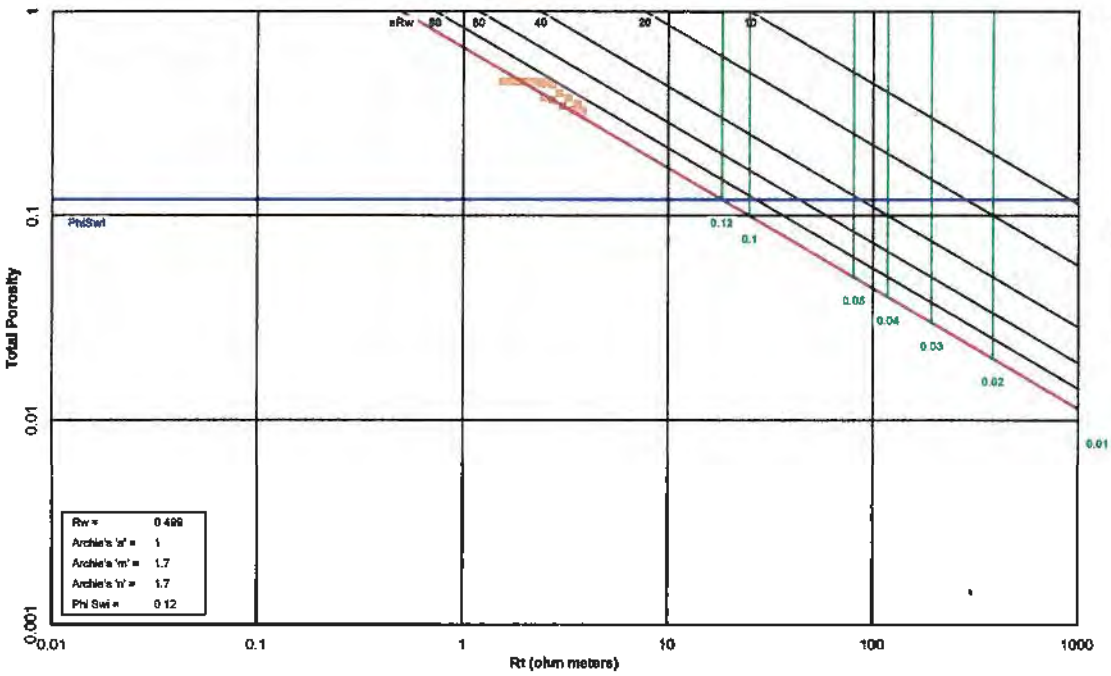


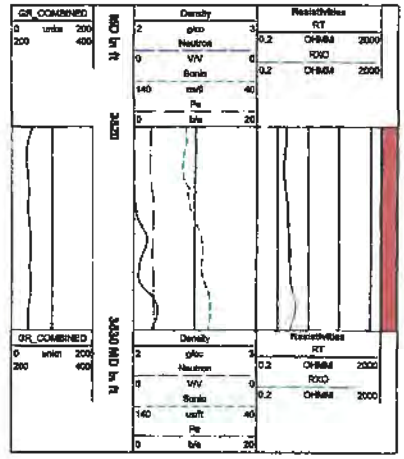
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges 3520-3530
Time: 01:29 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 166

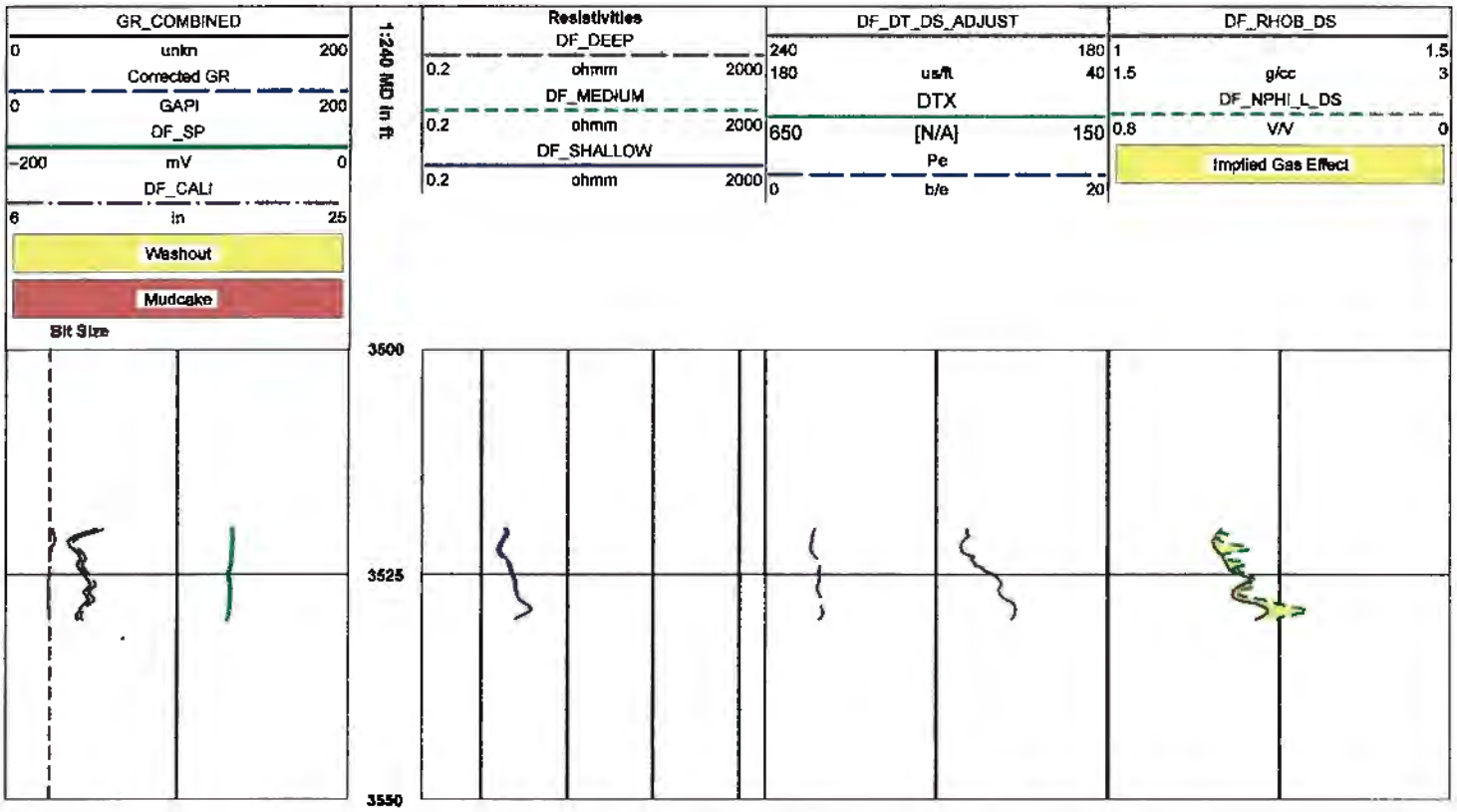
Rw= 0.499 Salinity 8800

DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3520-3530
Time: 01:28 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736

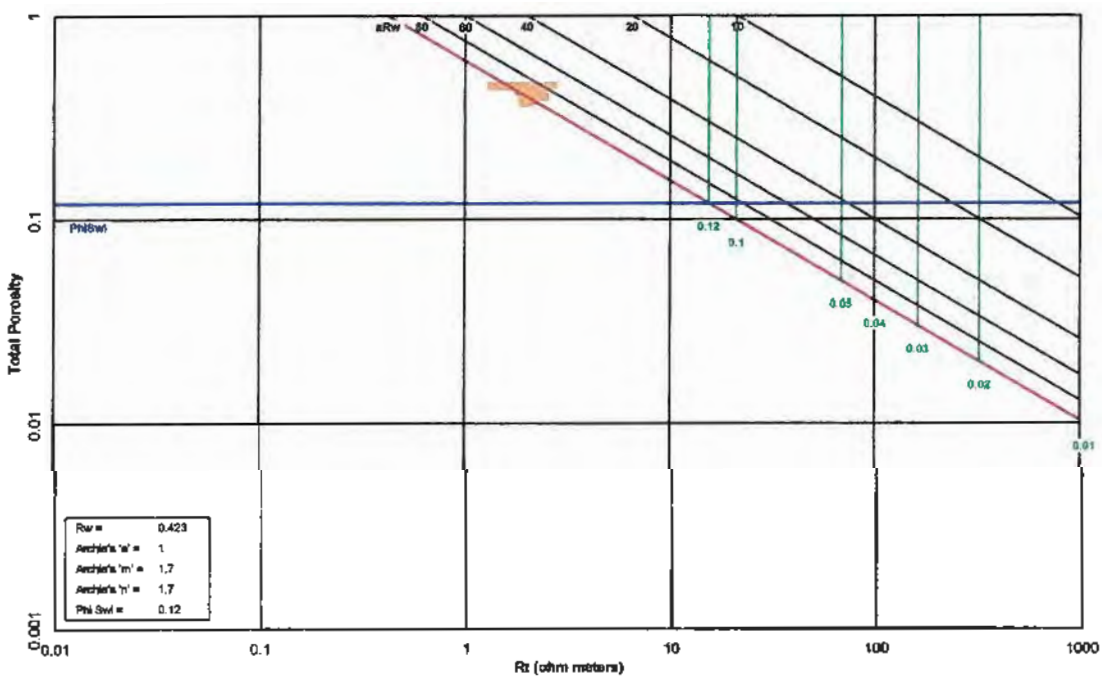


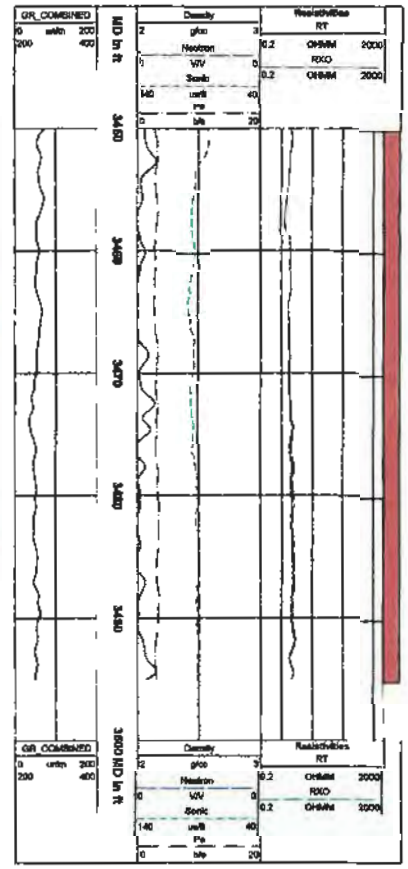
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3450-3495
Time: 01:26 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp : 105

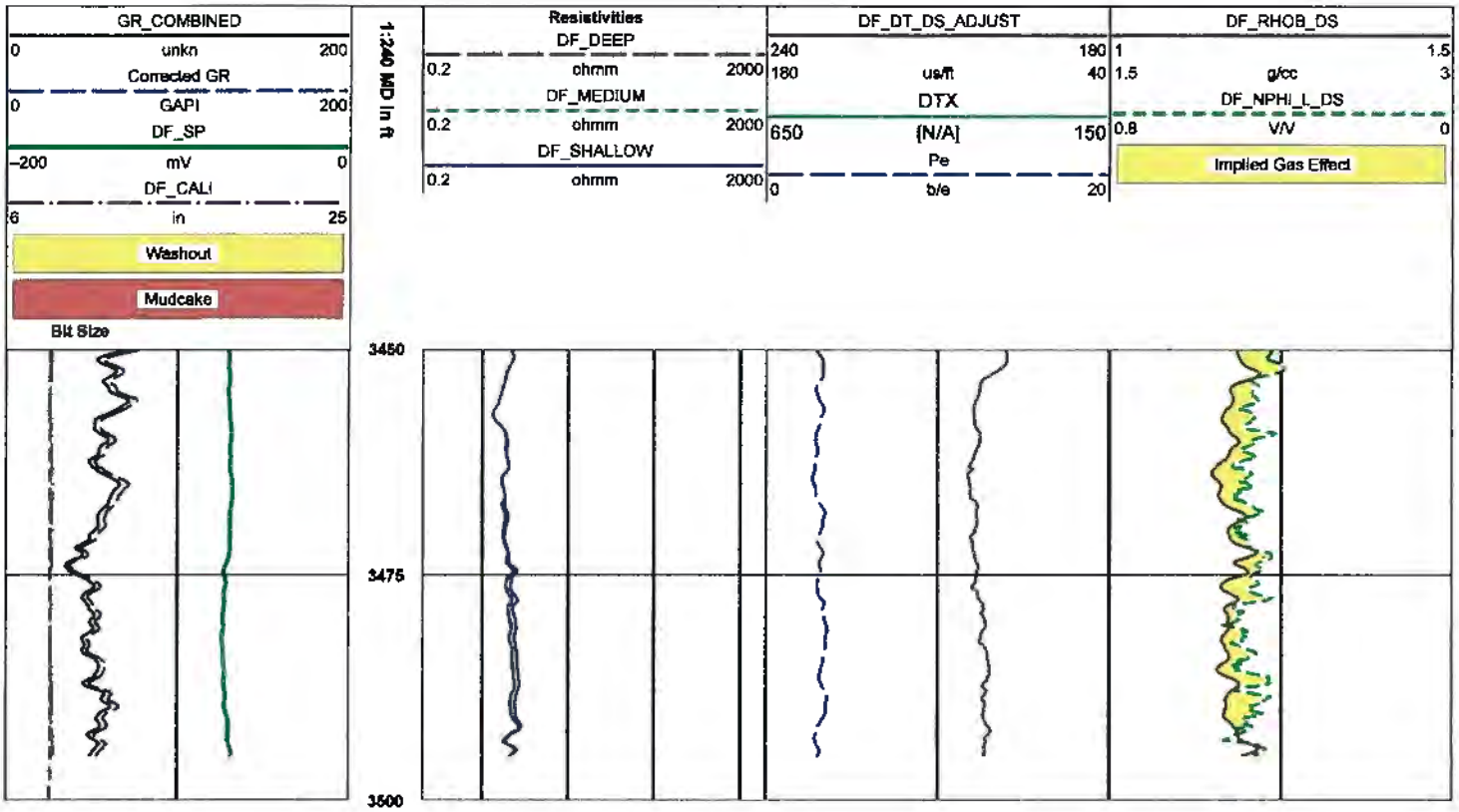
Rw = 0.423 Salinity 9500

DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3450-3495
Time: 01:26 PM
Section: 27
Location: LAT 38.08155572

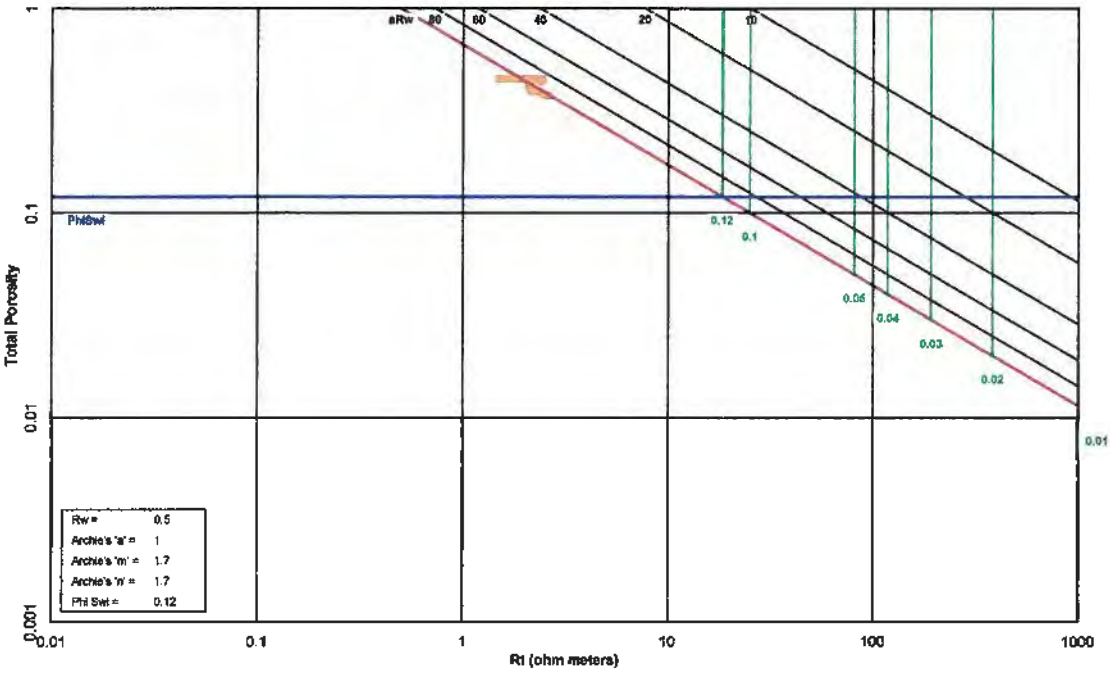
Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736

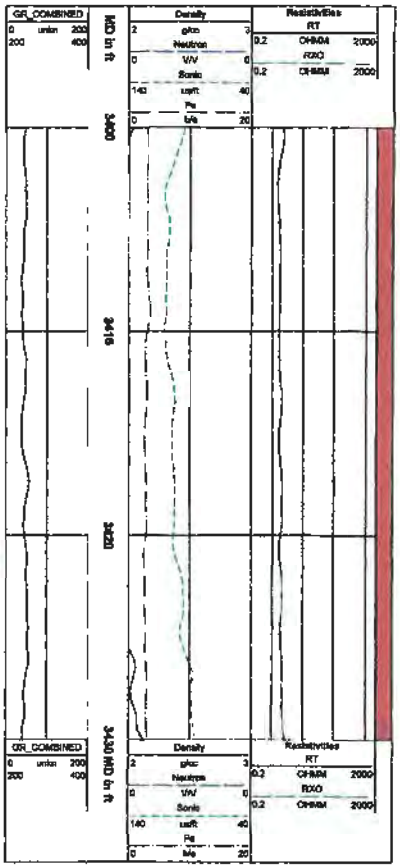


DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3400-3430
Time: 01:24 PM Date: Thu, Dec 12, 2013
Section: 27 Township: 3N API #: 04-077-20736
Location: LAT 38.08155572 Range: 5E UWI: 04-077-20736

Well Name: PlACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw





Temp 104

$R_w = 0,5$ Salinity 9000

DIGITAL FORMATION

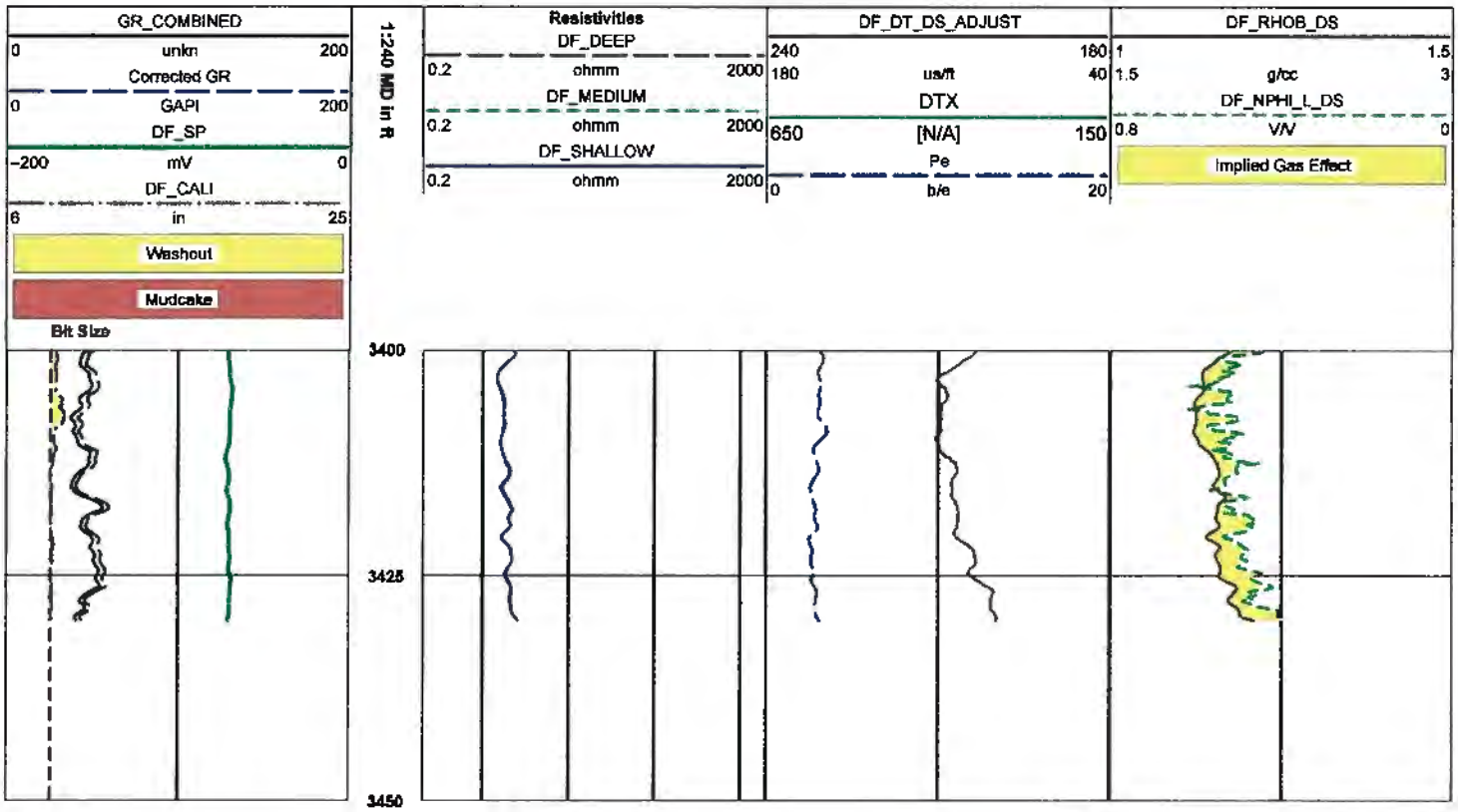
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3400-3430
Time: 01:23 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



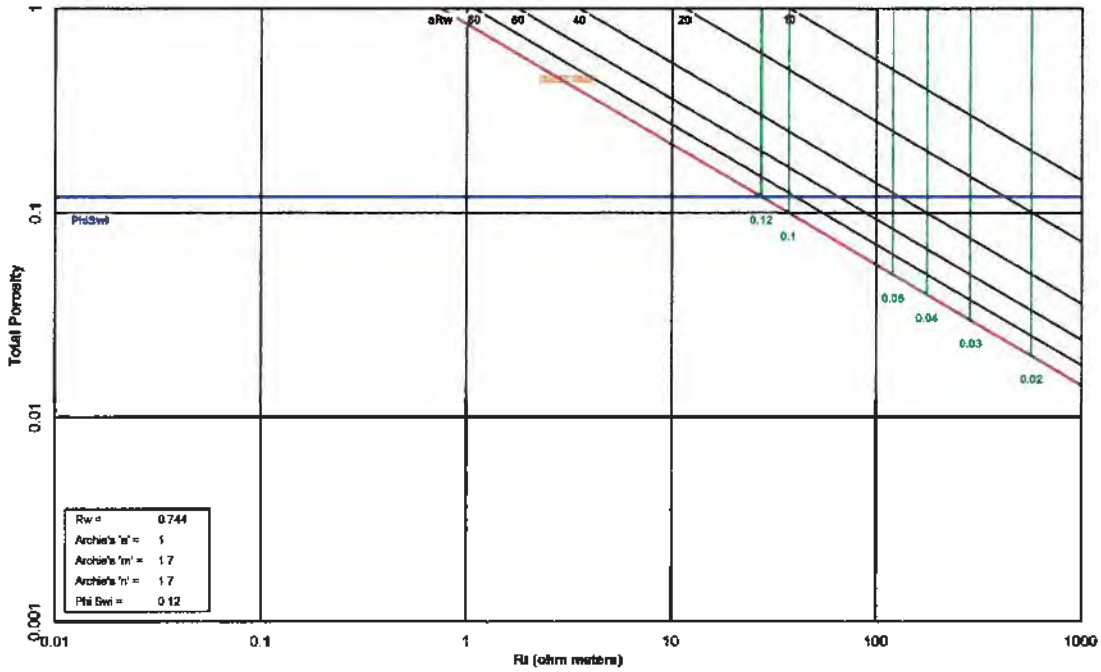
DIGITAL FORMATION

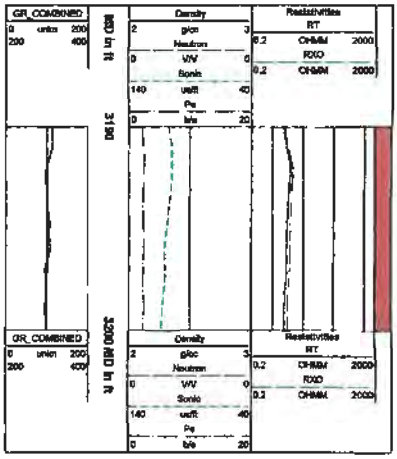
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3190-3200
Time: 01:21 PM
Section: 27
Location: LAT 38.06155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 106

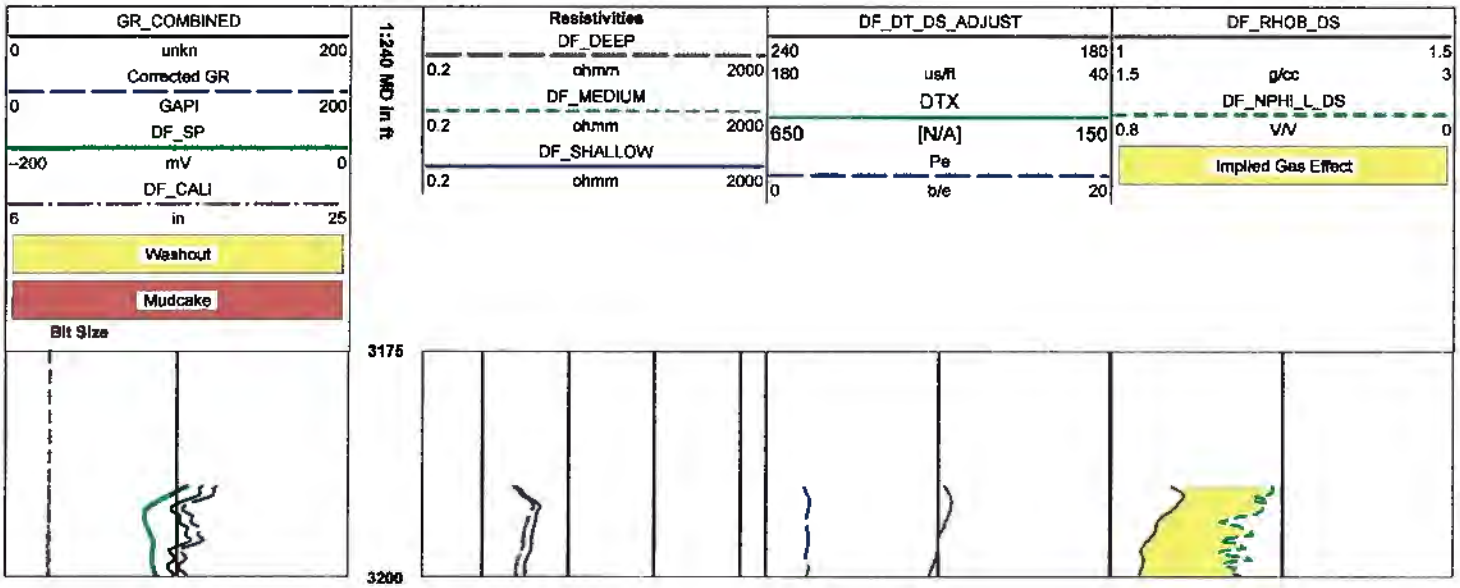
Rw 0.744 Salty 6000

DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3190-3200
Time: 01:22 PM
Section: 27
Location: LAT 38.08155572

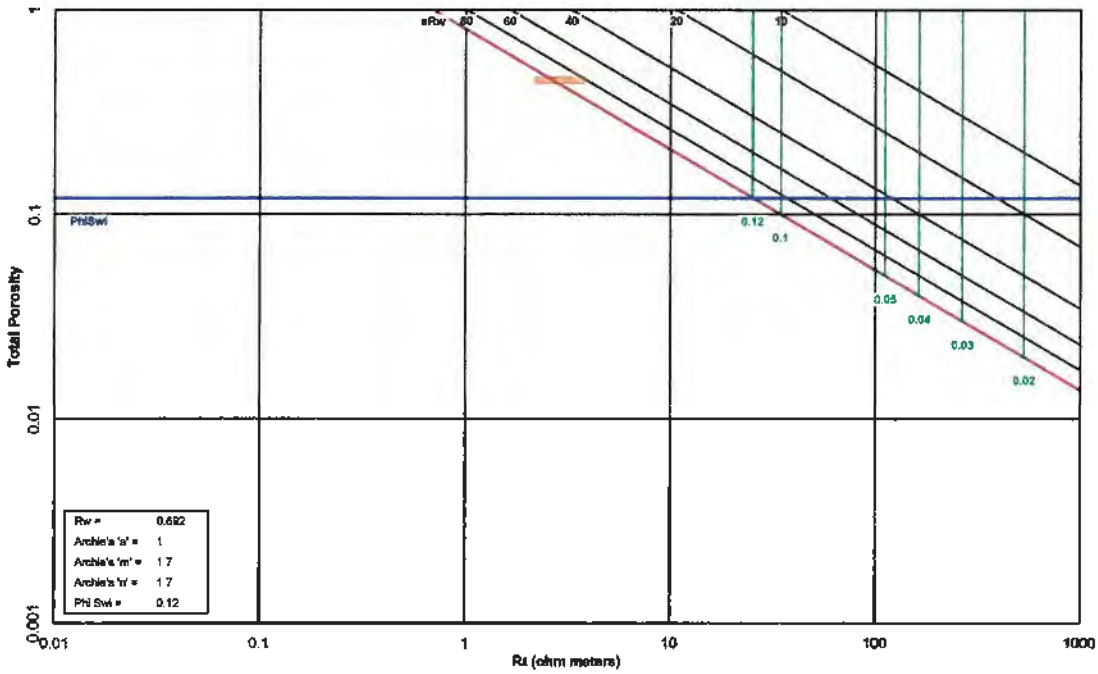
Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736

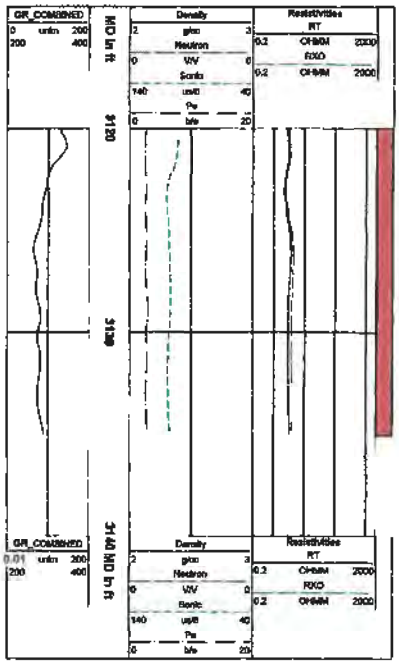


LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3120-3135
Time: 01:20 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 100

Rw = 0.692 Salinity 6500

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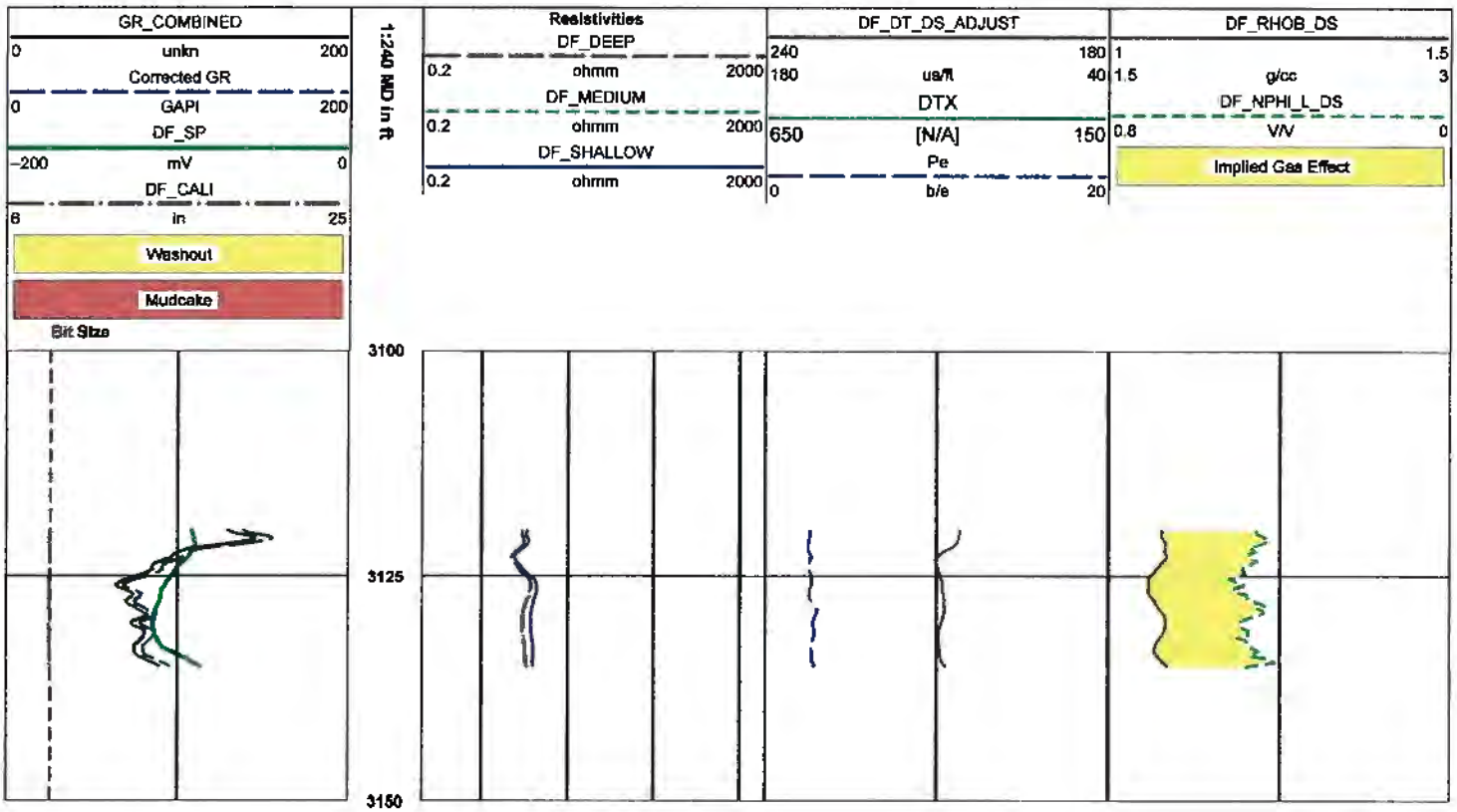
DIGITAL FORMATION

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
3120-3135
Time: 01:19 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



Temp 100

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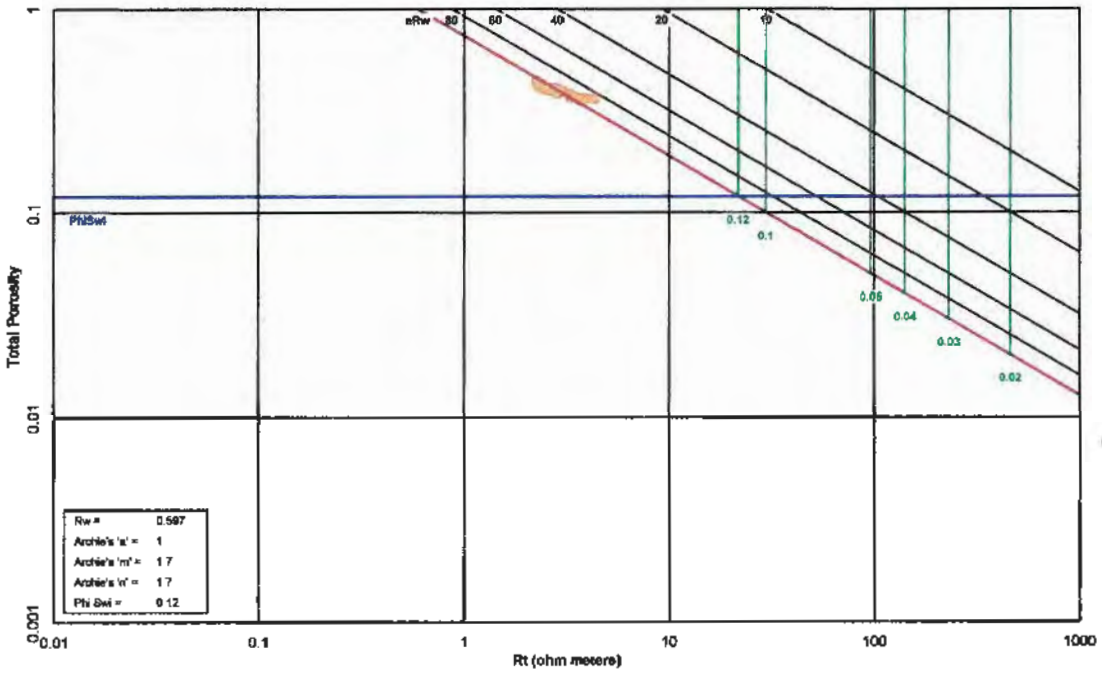
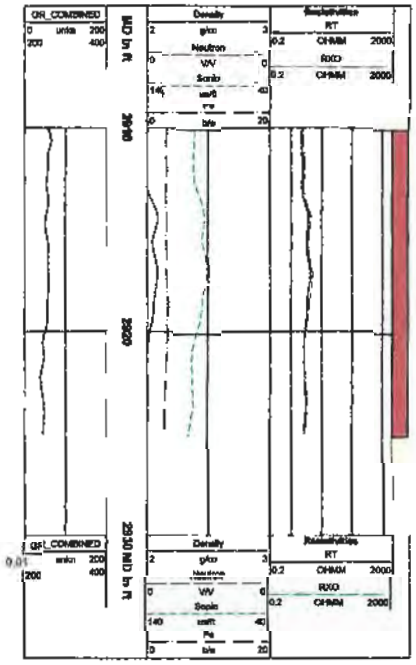
DIGITAL FORMATION

File: Placentine 2-27 lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
2810-2925
Time: 01:17 PM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 98

Rw: 0.597 Salt 7000

DIGITAL FORMATION

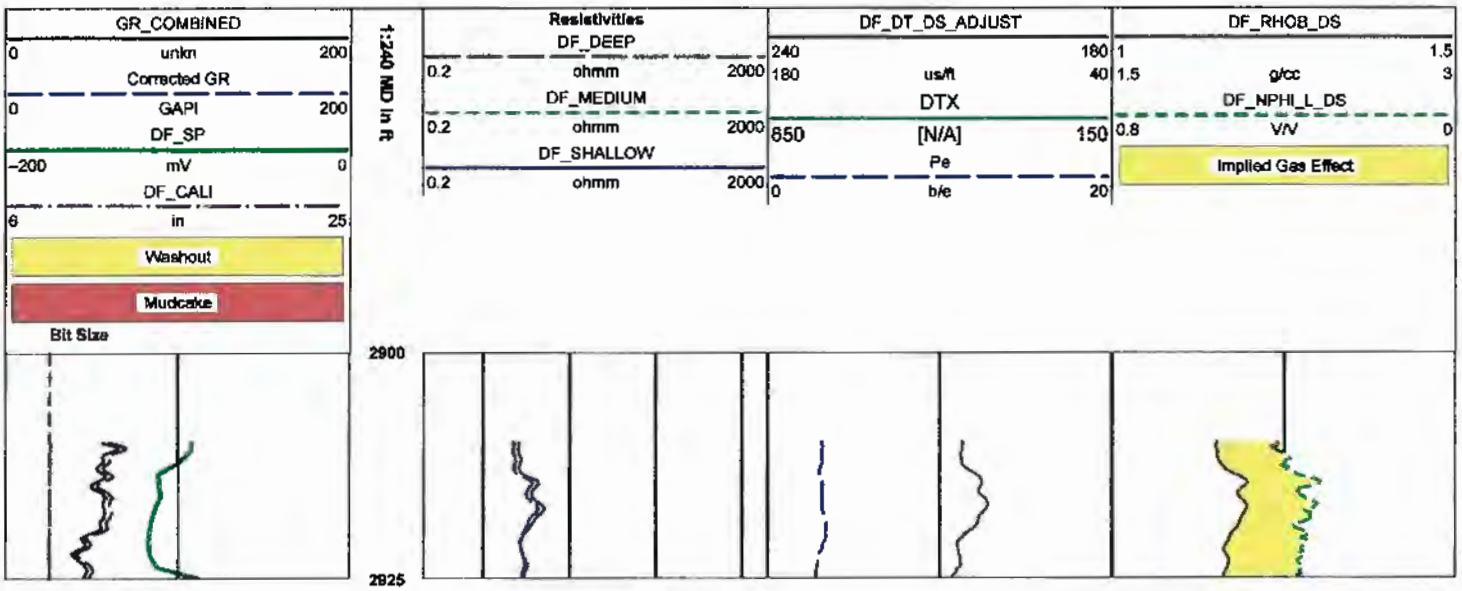
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
2910-2925
Time: 01:17 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

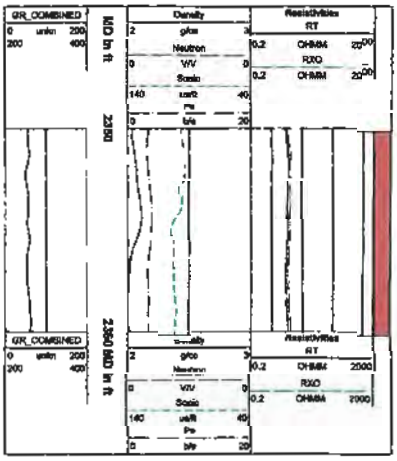
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

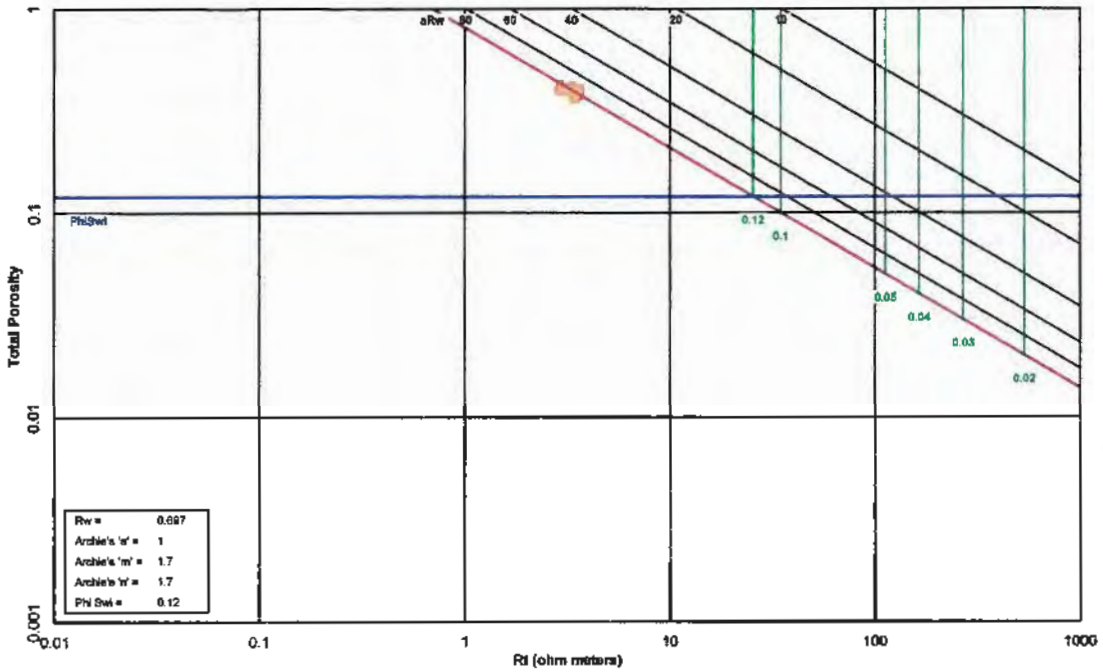
API #: 04-077-20736
UWI: 04-077-20736



LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
2350-2360
Time: 01:05 PM Date: Thu, Dec 12, 2013
Section: 27 Township: 3N API #: 04-077-20736
Location: LAT 38.08155572 Range: 5E UWI: 04-077-20736

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw





Temp 90

Rw 0.697 Salinity 7000

DIGITAL FORMATION

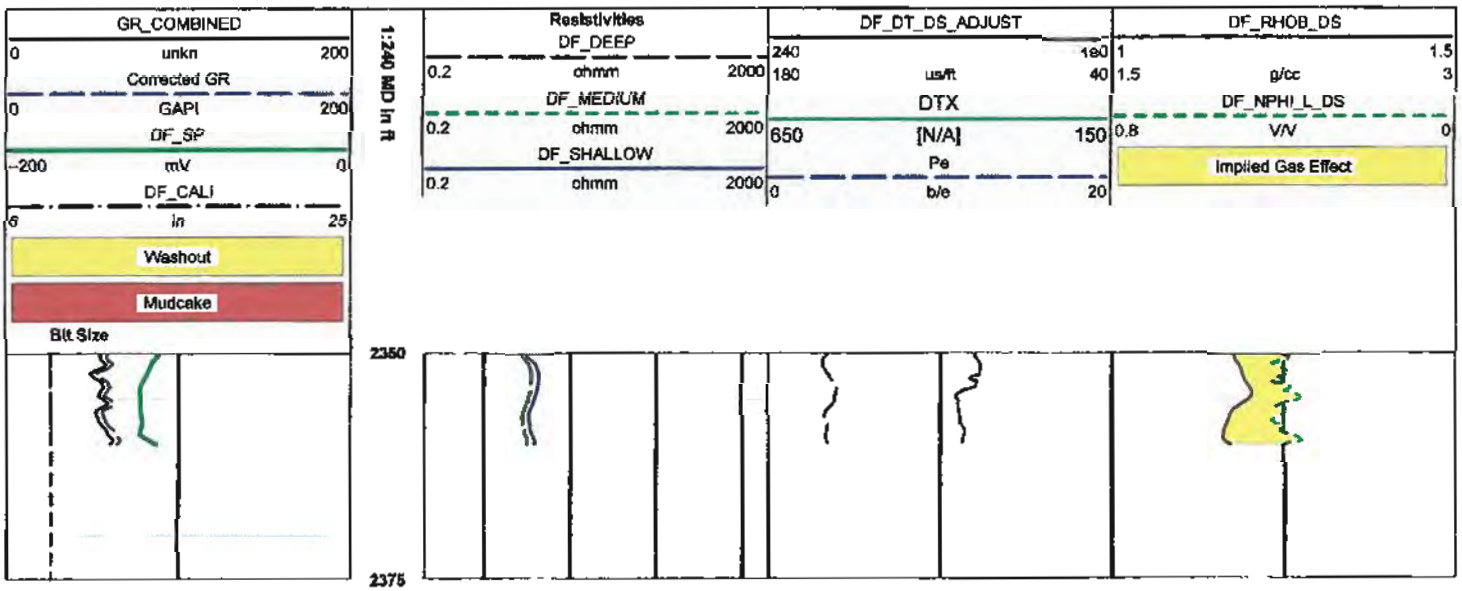
LESA 9.0, © 1992-2010 Digital Formation, Inc.

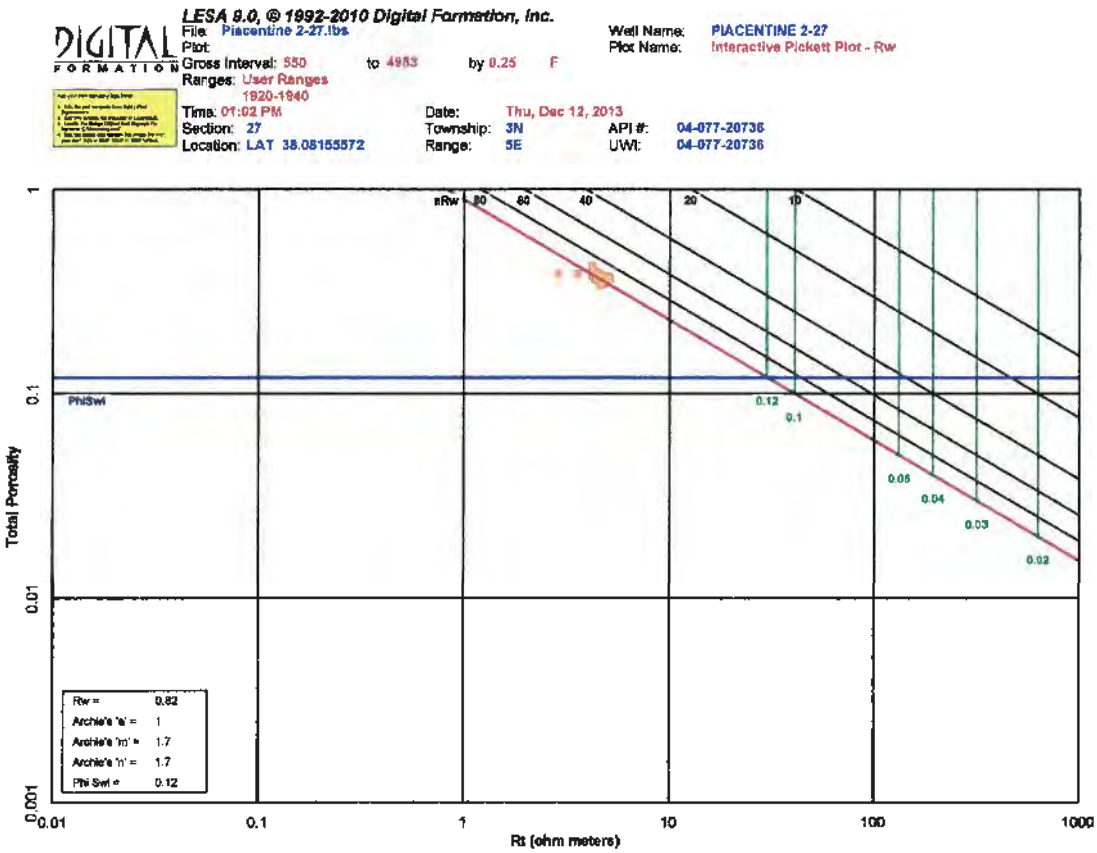
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
2350-2360
Time: 01:05 PM
Section: 27
Location: LAT 38.08155572

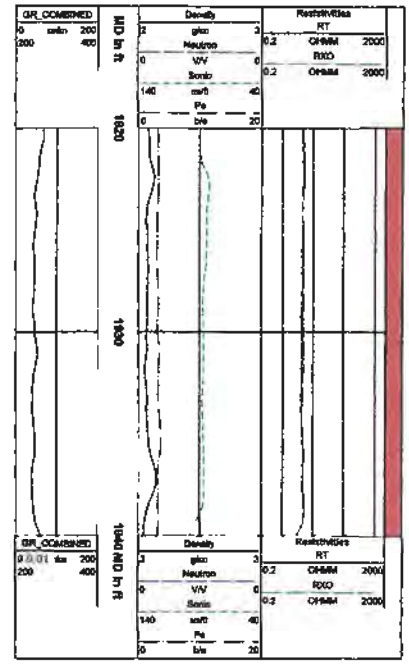
Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736







Temp 85

Rw v 82 Salinity 6500

DIGITAL FORMATION

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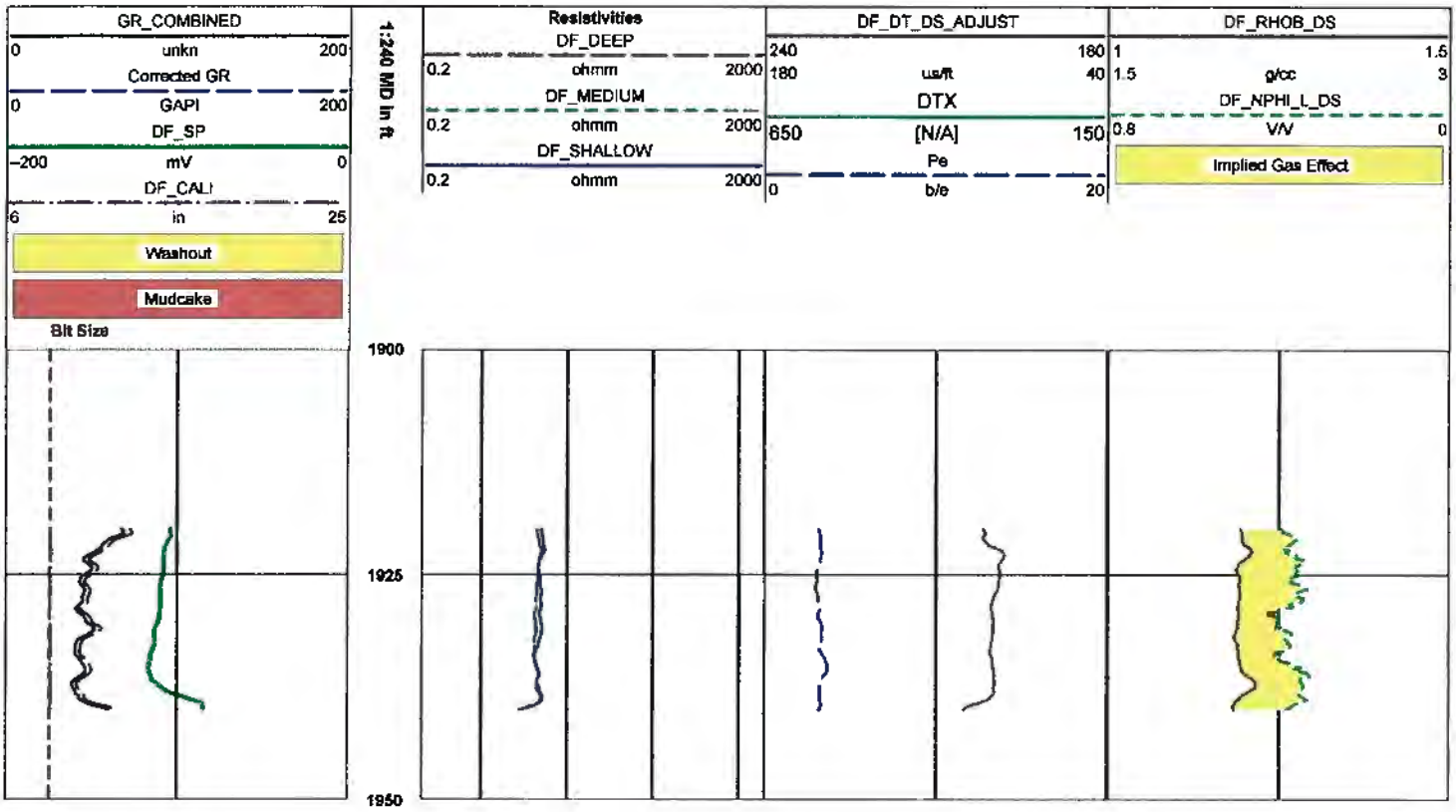
File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1920-1940
Time: 01:02 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)
Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736

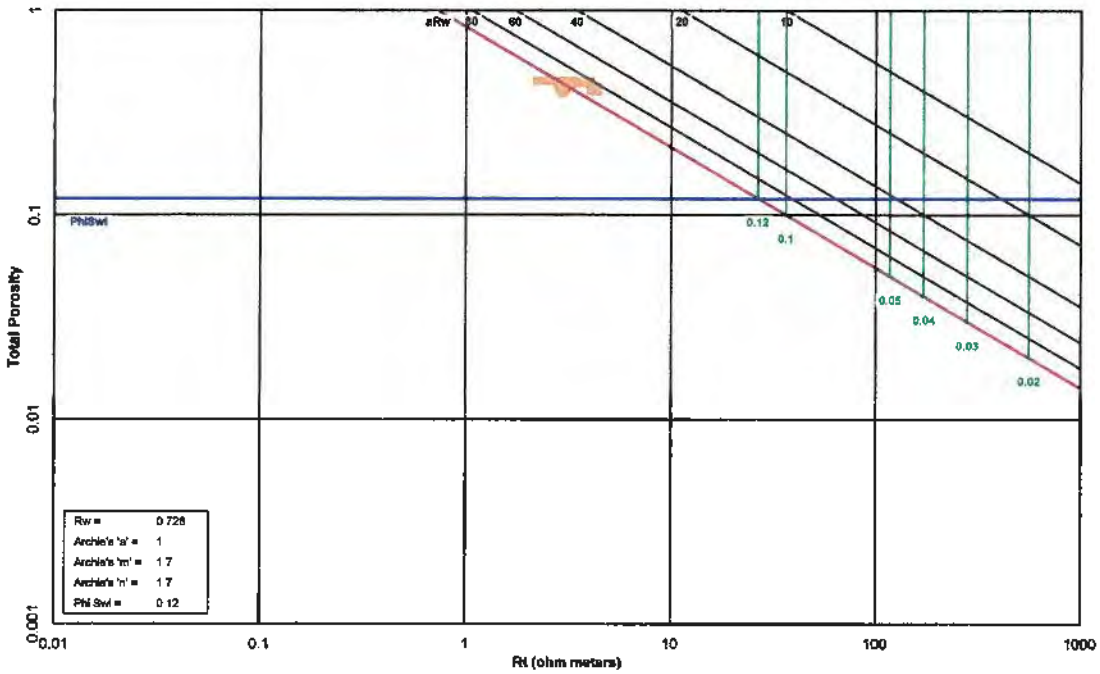


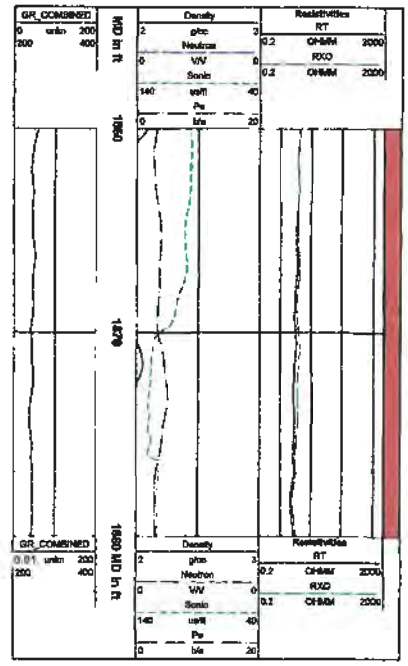
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1860-1880
Time: 12:59 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 84

Rw 0.728 Sating 7000

DIGITAL FORMATION

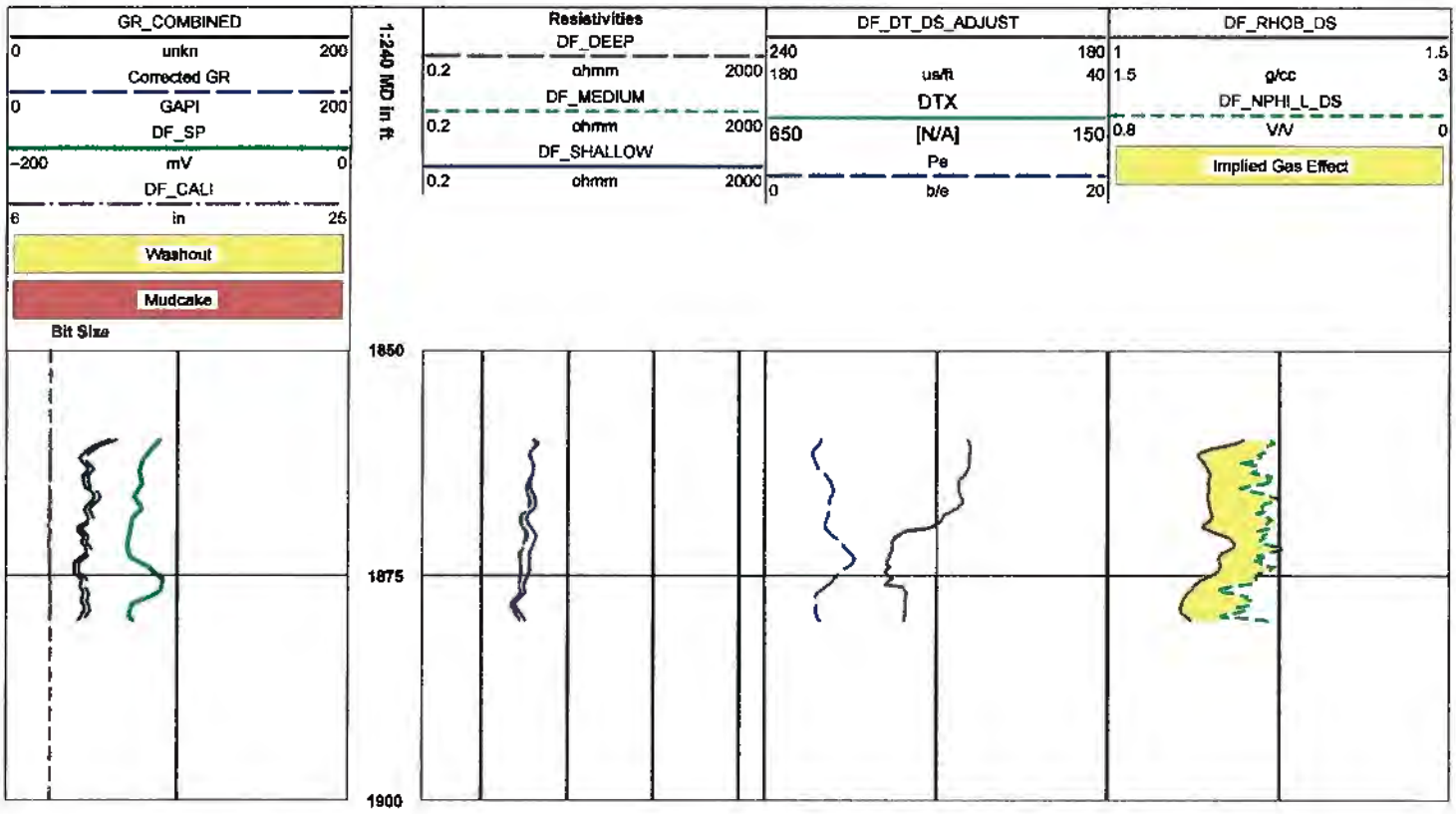
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: **Piacentine 2-27.lbs**
Plot:
Gross Interval: **550** to **4983** by **0.25** **F**
Ranges: **User Ranges**
1860-1880
Time: **12:59 PM**
Section: **27**
Location: **LAT 38.08155572**

Well Name: **PIACENTINE 2-27**
Plot Name: **Raw Data Log (US and Canada)**

Date: **Thu, Dec 12, 2013**
Township: **3N**
Range: **5E**

API #: **04-077-20736**
UWI: **04-077-20736**



DIGITAL FORMATION

LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.fbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1830-1850
Time: 12:57 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
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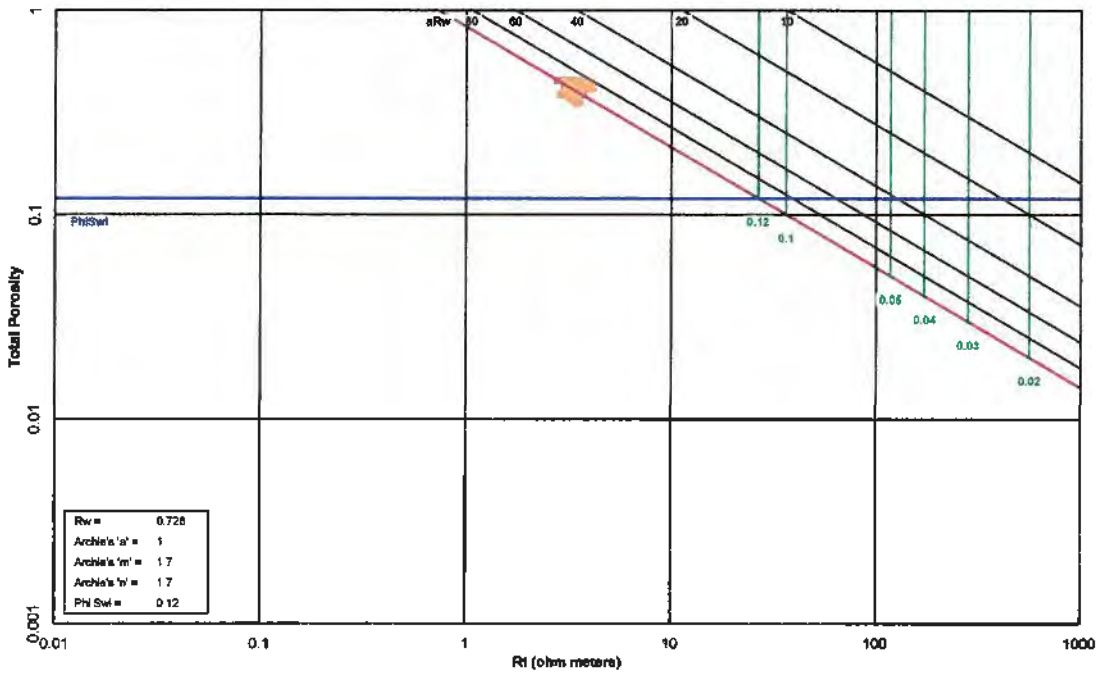
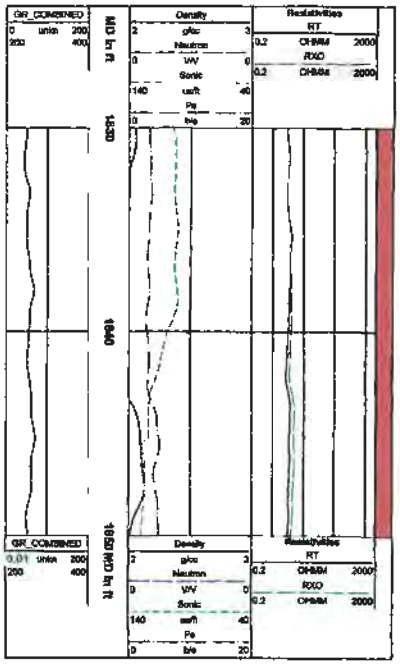
UWI: 04-077-20738





Temp 84

R_w = 0.728 Salinity 7000

DIGITAL FORMATION

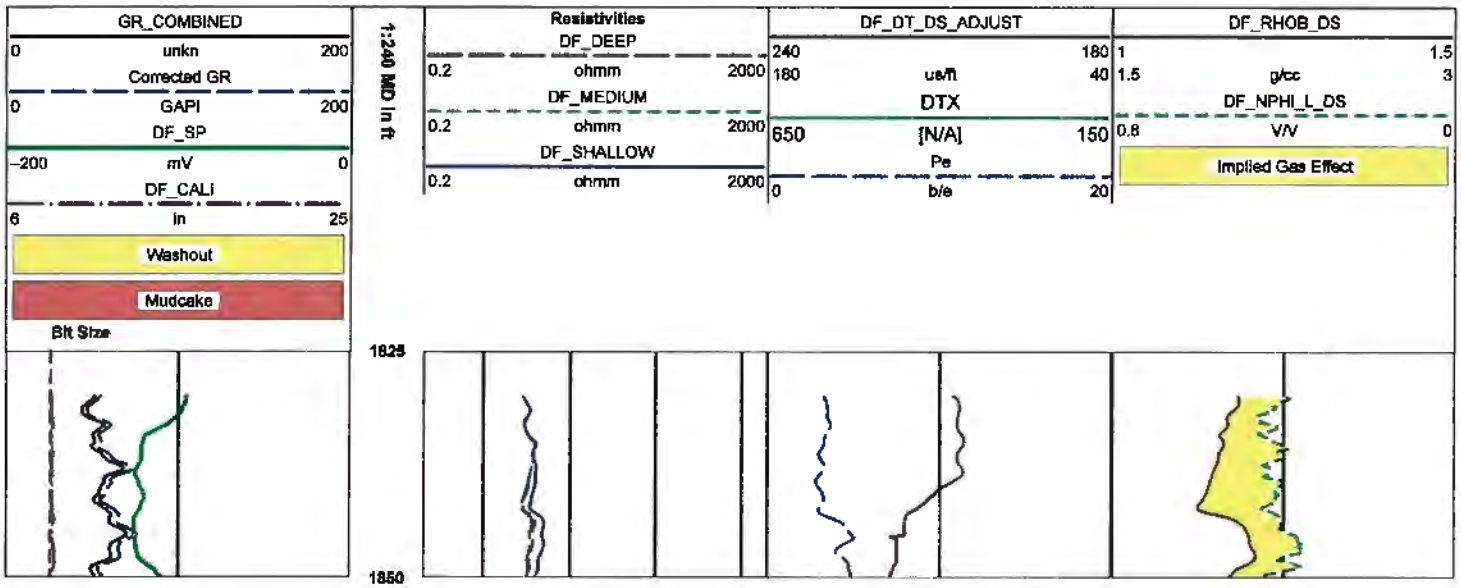
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1830-1850
Time: 12:56 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

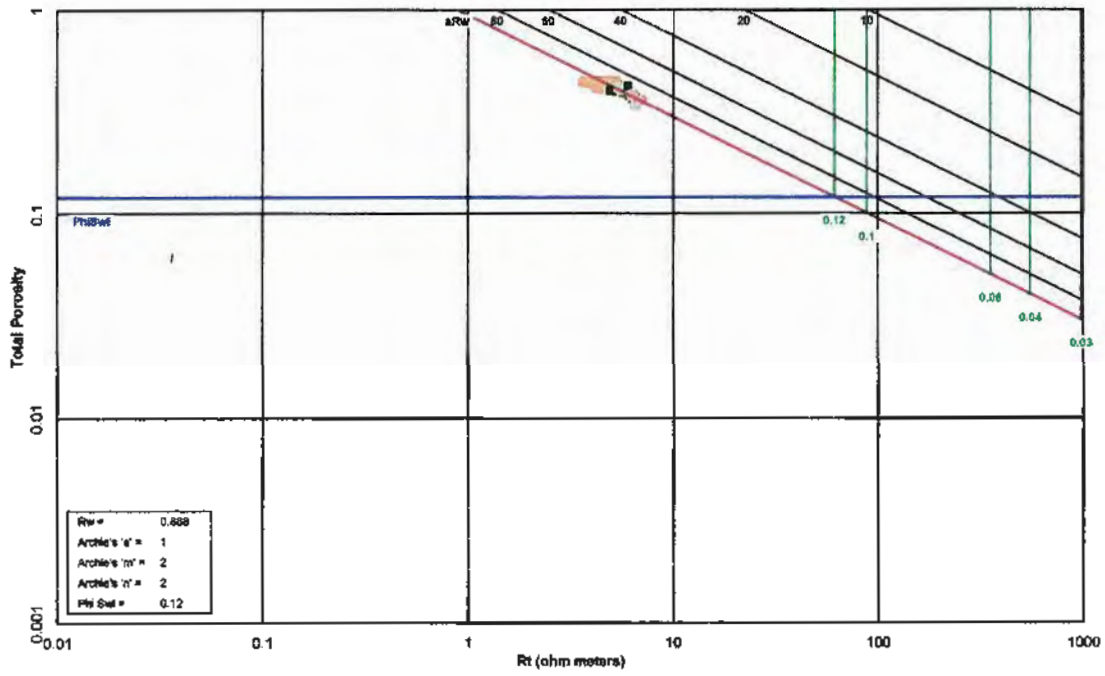
API #: 04-077-20736
UWI: 04-077-20736

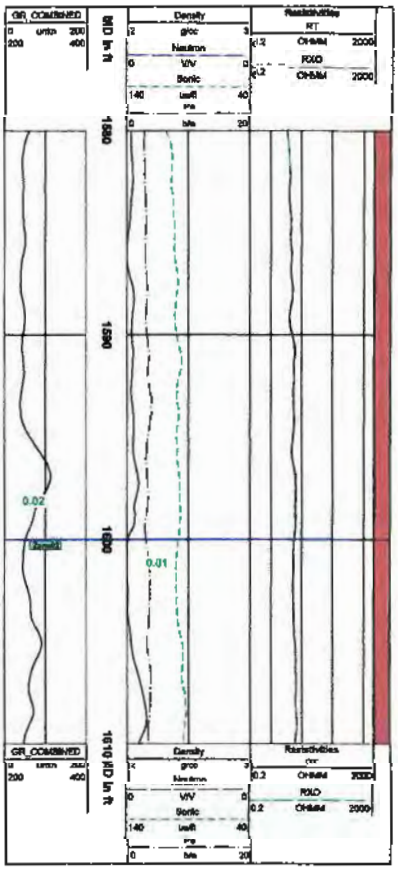


LESA 9.0, © 1992-2010 Digital Formation, Inc.
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1580-1610
Time: 12:49 PM
Section: 27
Location: LAT 38.08155572

Well Name: PLACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20735
UWI: 04-077-20735





Temp: 81

Rw 0.888 Salinity: 6300

DIGITAL FORMATION

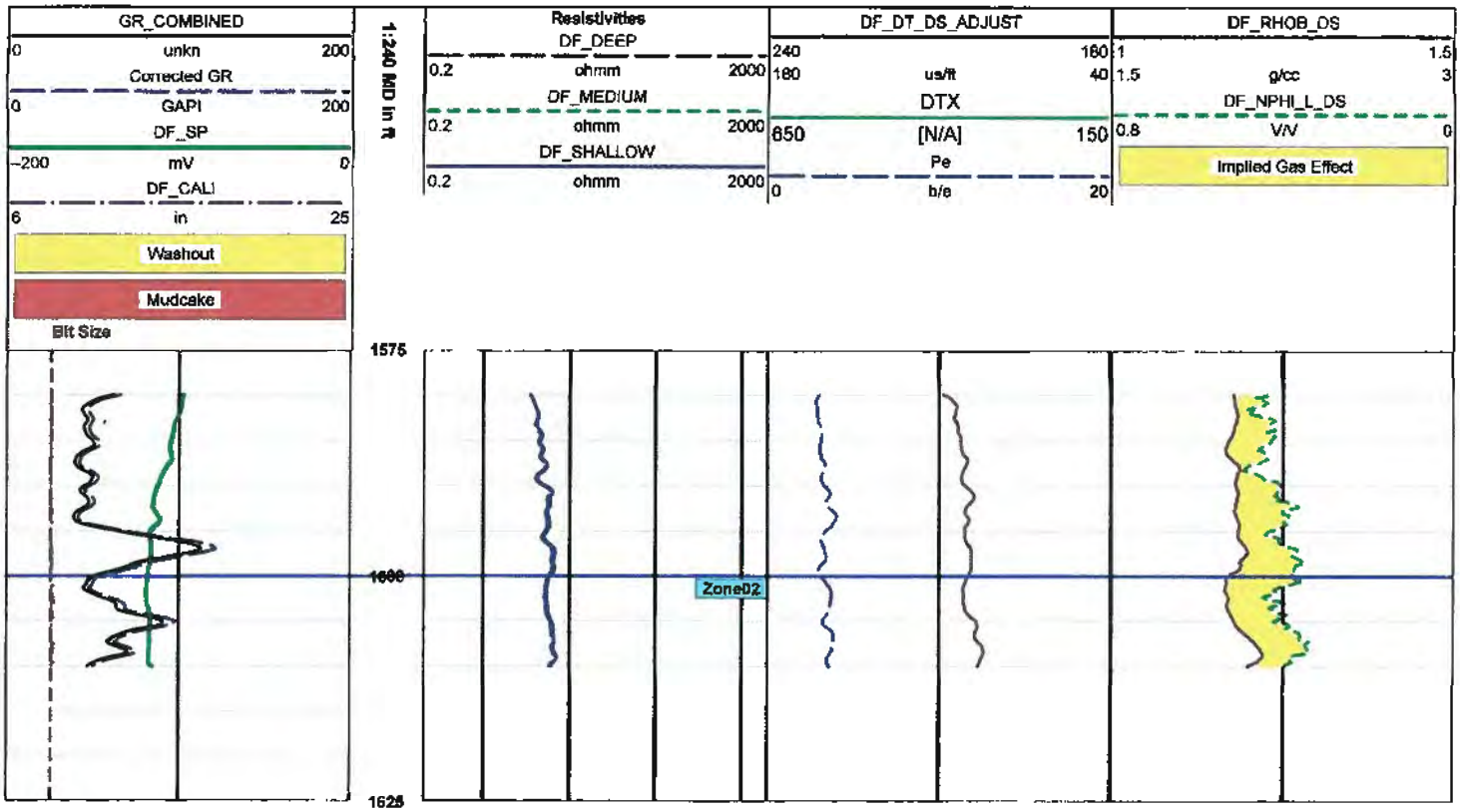
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1580-1610
Time: 12:49 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



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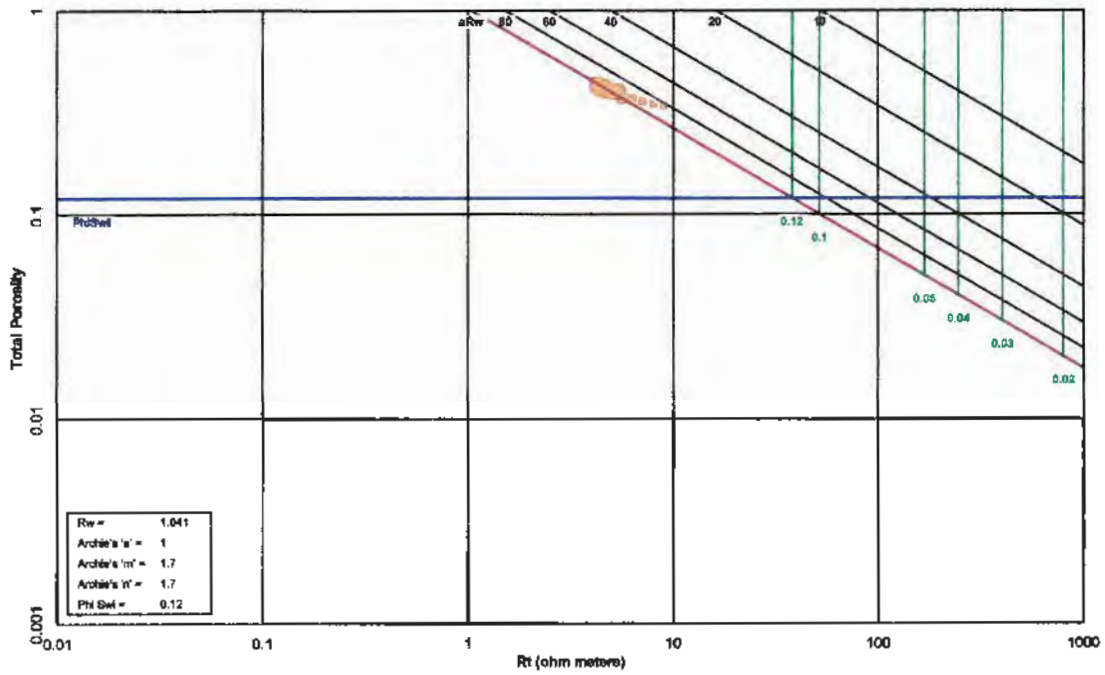
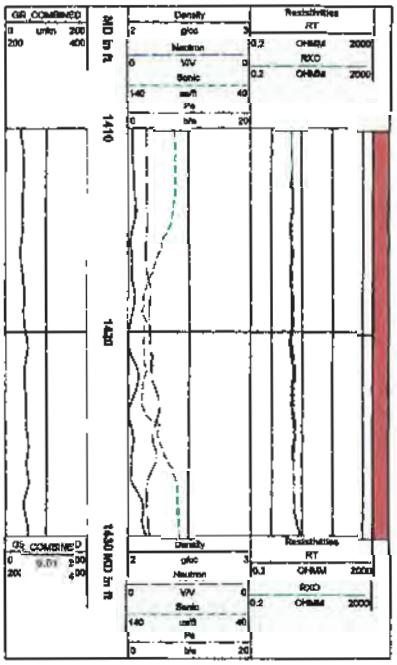
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1410-1430
Time: 12:45 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N API #: 04-077-20736
Range: 5E UWI: 04-077-20736





Temp = 78

Rw = 1.041 Salinity 5500

DIGITAL FORMATION

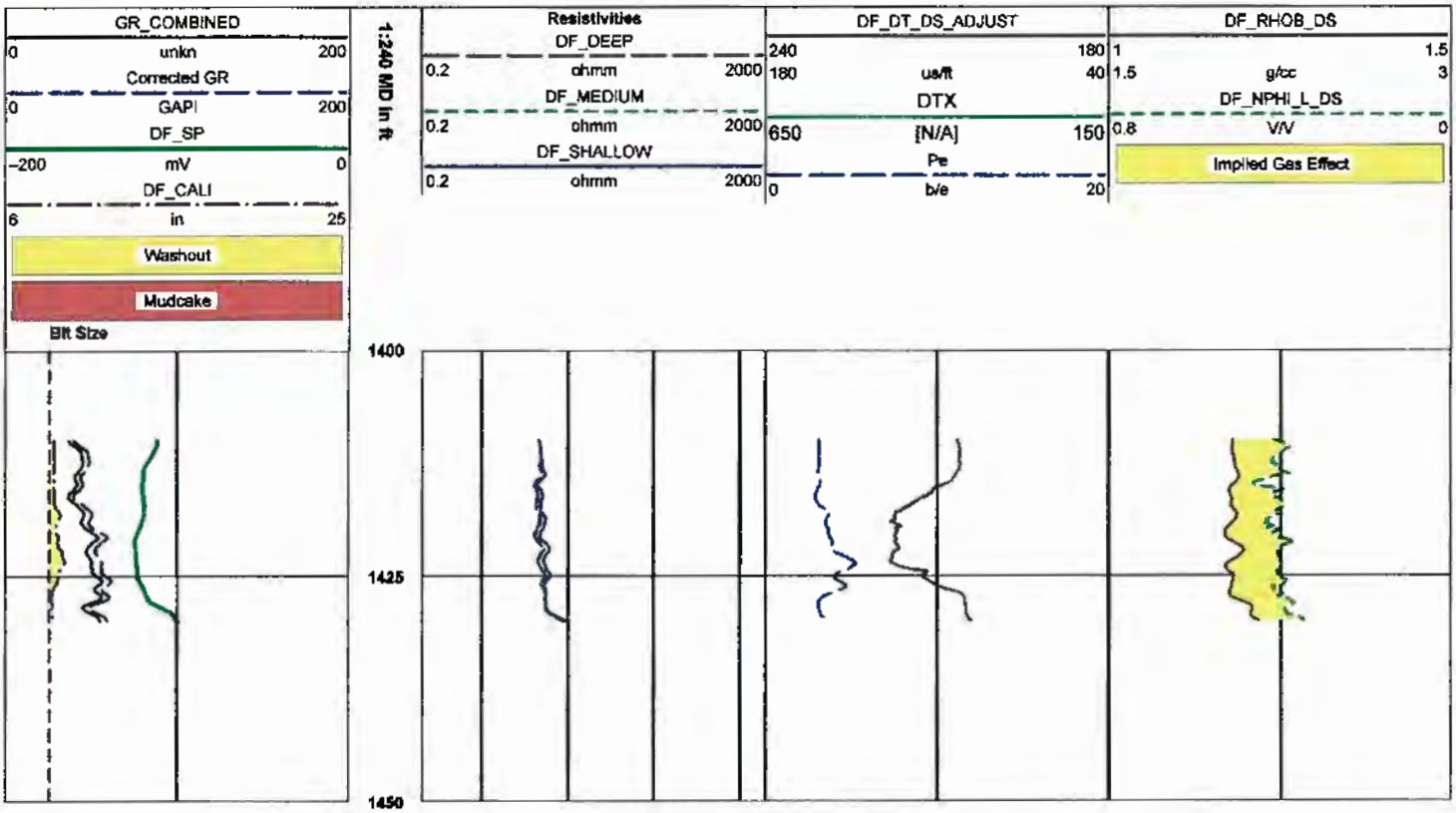
LESA 9.0, © 1992-2010 Digital Formation, Inc.

File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1410-1430
Time: 12:45 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



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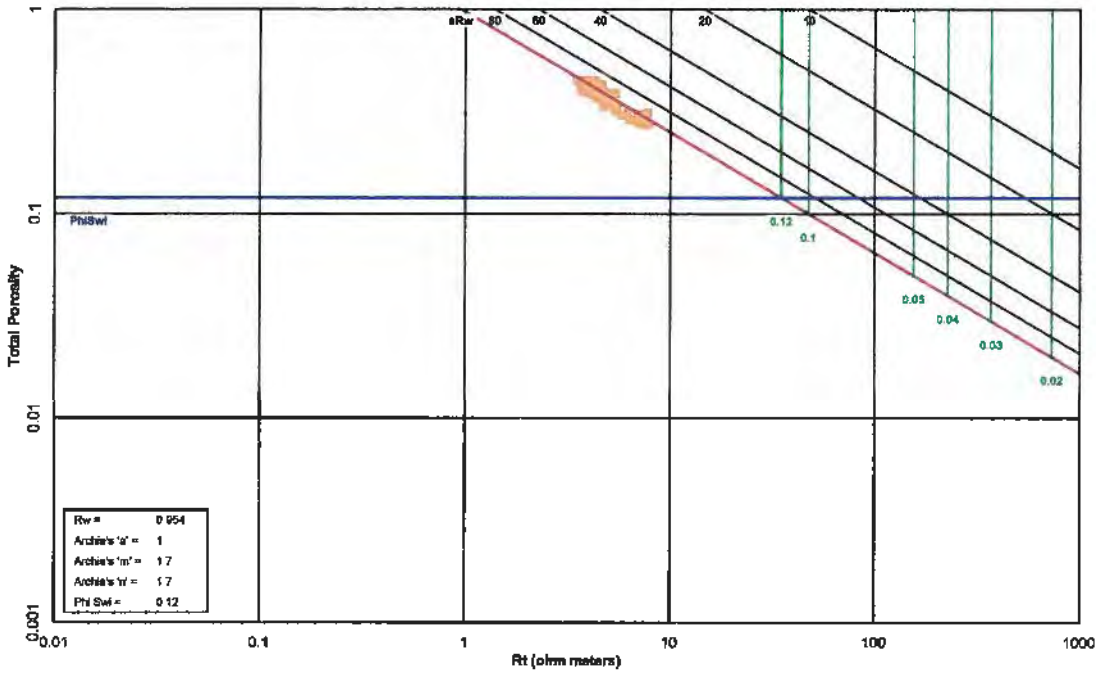
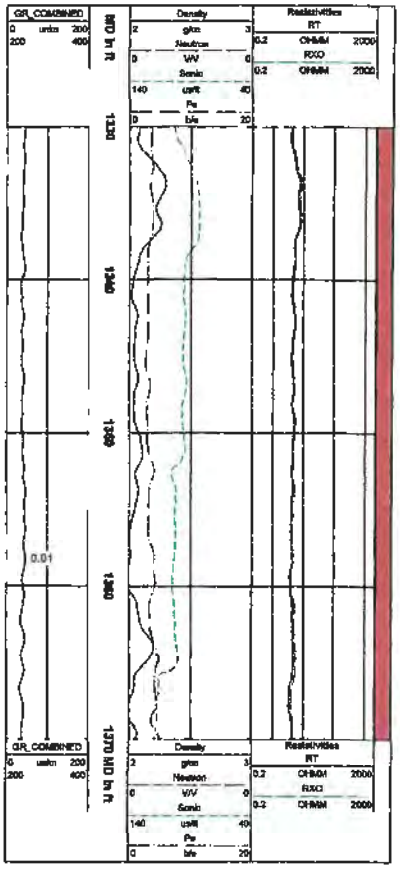
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1330-1370
Time: 12:43 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp YB

Rw 0.954 Salty 6000

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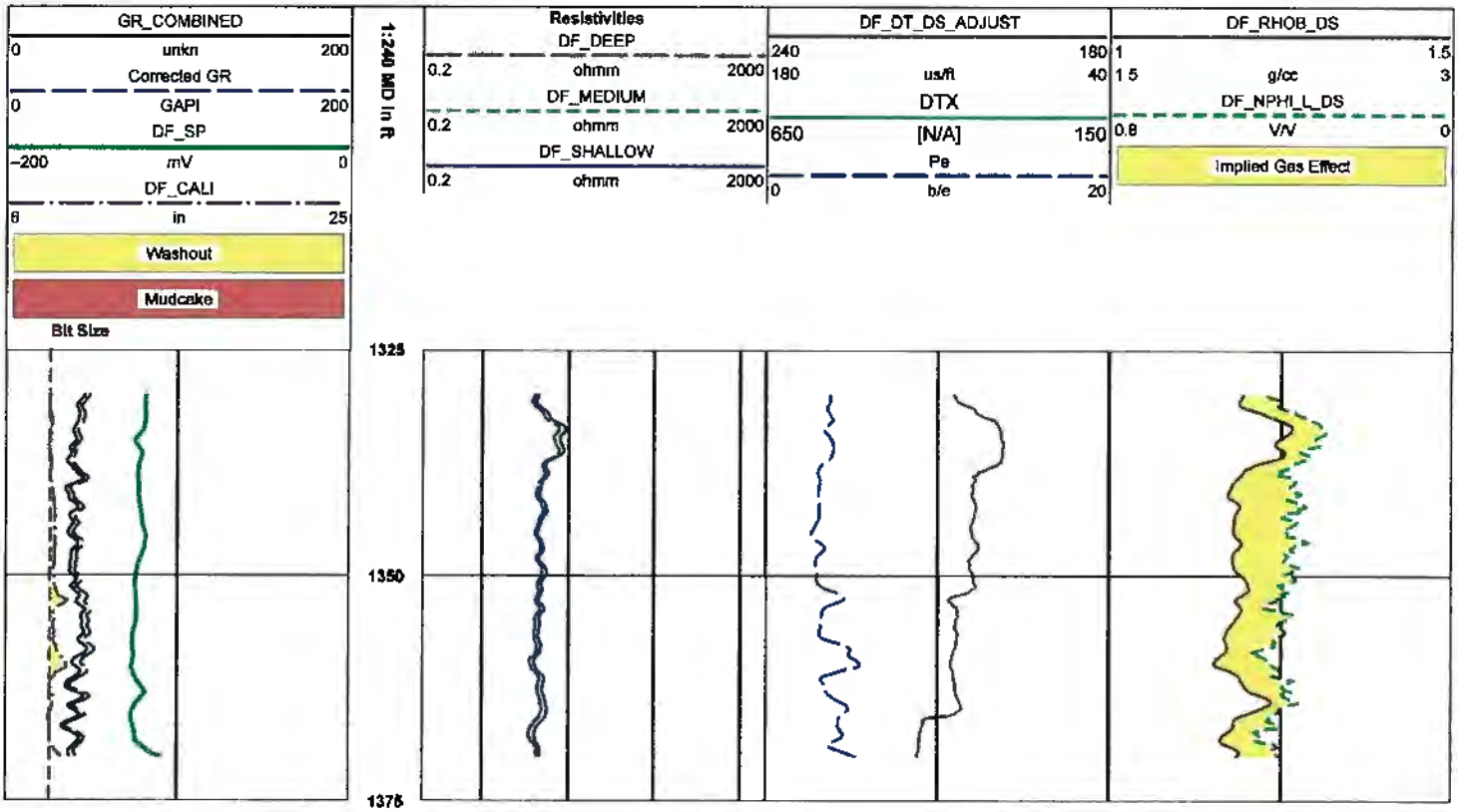
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1330-1370
Time: 12:44 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



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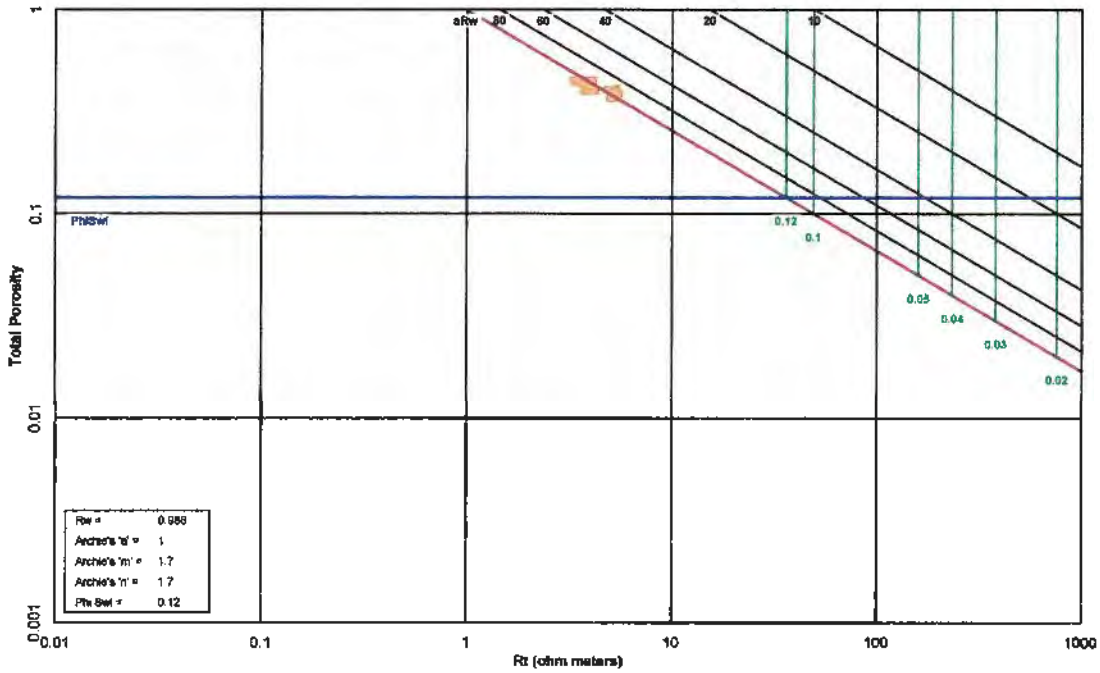
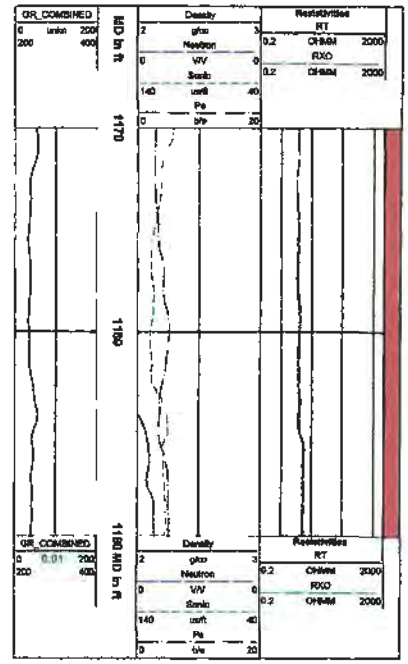
File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1170-1190
Time: 12:24 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Interactive Pickett Plot - Rw

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E
API #: 04-077-20736
UWI: 04-077-20736





Temp 75

Rw= 0.986 Satuf 6000

DIGITAL FORMATION

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File: Piacentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
1170-1190
Time: 12:23 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)
Date: Thu, Dec 12, 2013
Township: 3N
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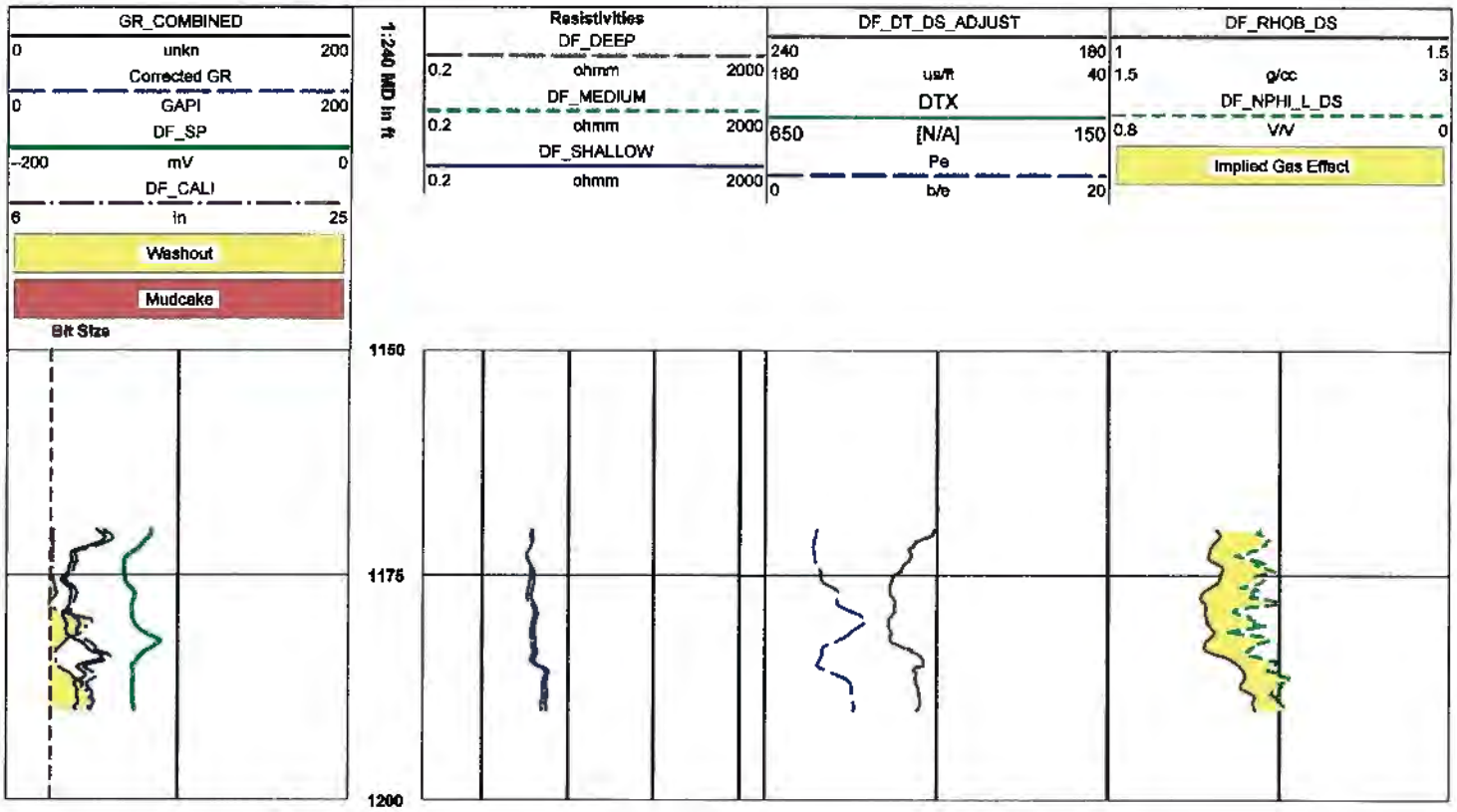
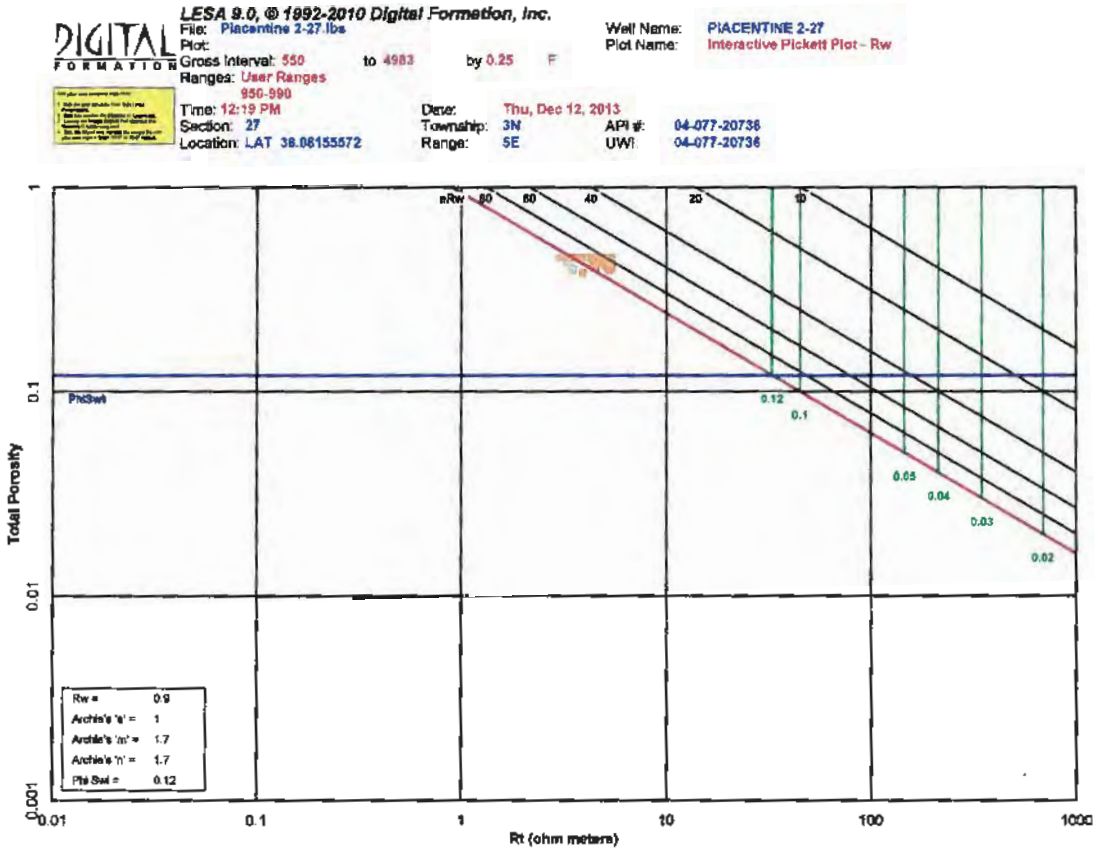
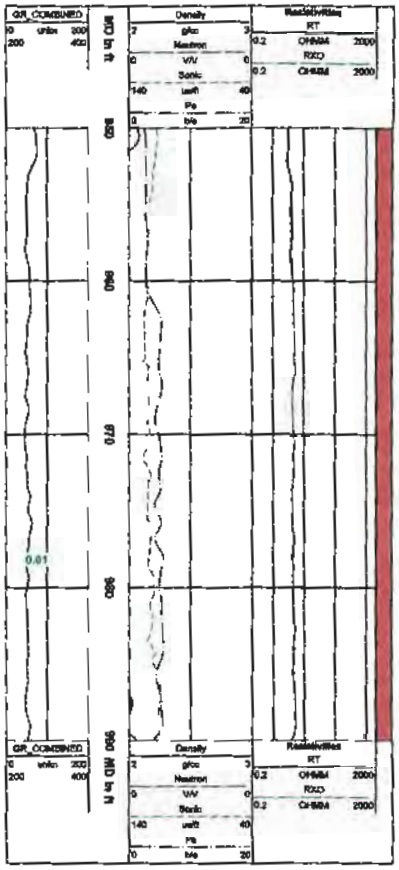
UWI: 04-077-20736







Temp = 72

Rw: 0.9 Salinity 6700

DIGITAL FORMATION

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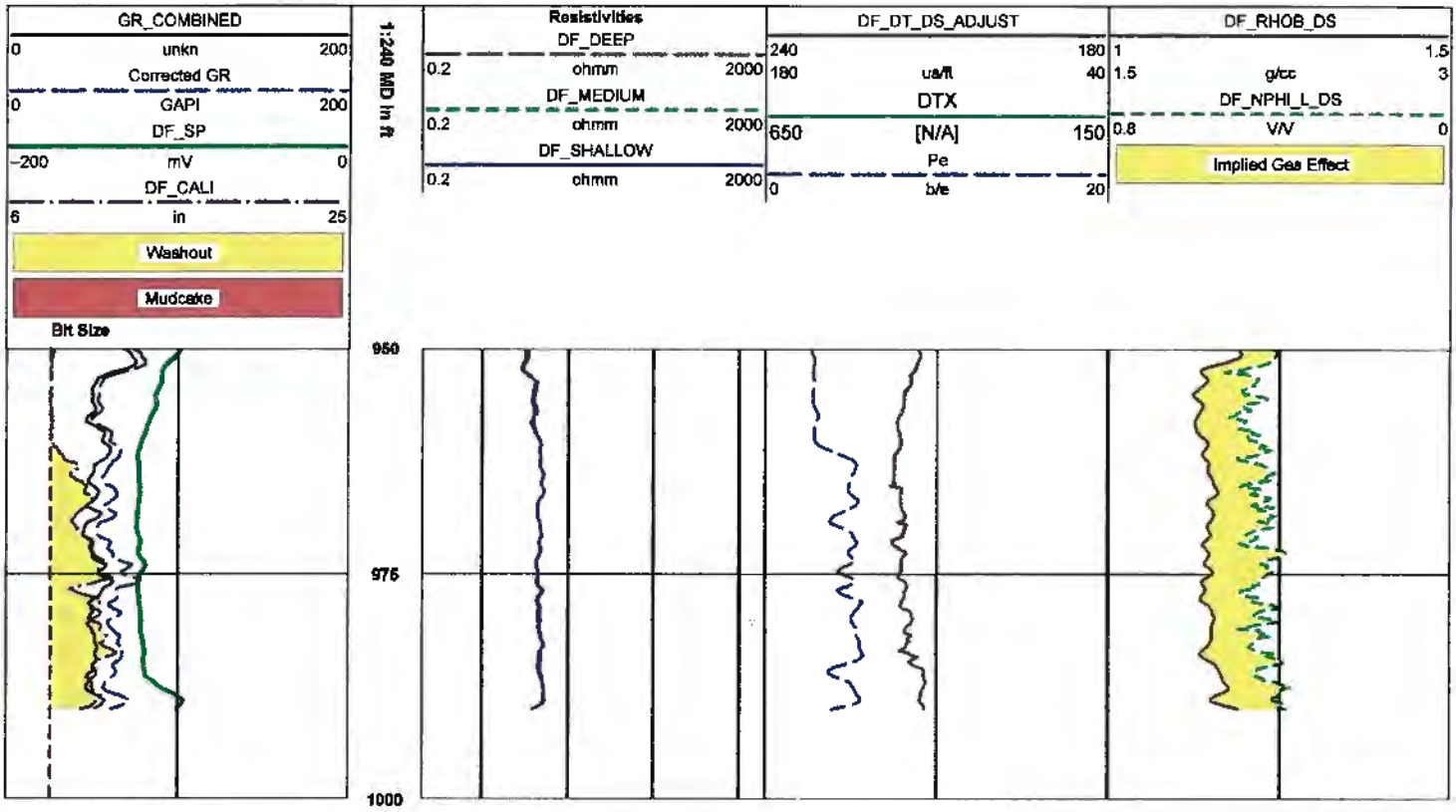
File: Placentine 2-27.lbs
Plot:
Gross Interval: 550 to 4983 by 0.25 F
Ranges: User Ranges
950-990
Time: 12:19 PM
Section: 27
Location: LAT 38.08155572

Well Name: PIACENTINE 2-27
Plot Name: Raw Data Log (US and Canada)

Date: Thu, Dec 12, 2013
Township: 3N
Range: 5E

API #: 04-077-20736
UWI: 04-077-20736



ATTACHMENT F

Maps and Cross Sections of Geologic Structure of Area

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Figure F-7 Structure Section C-C'
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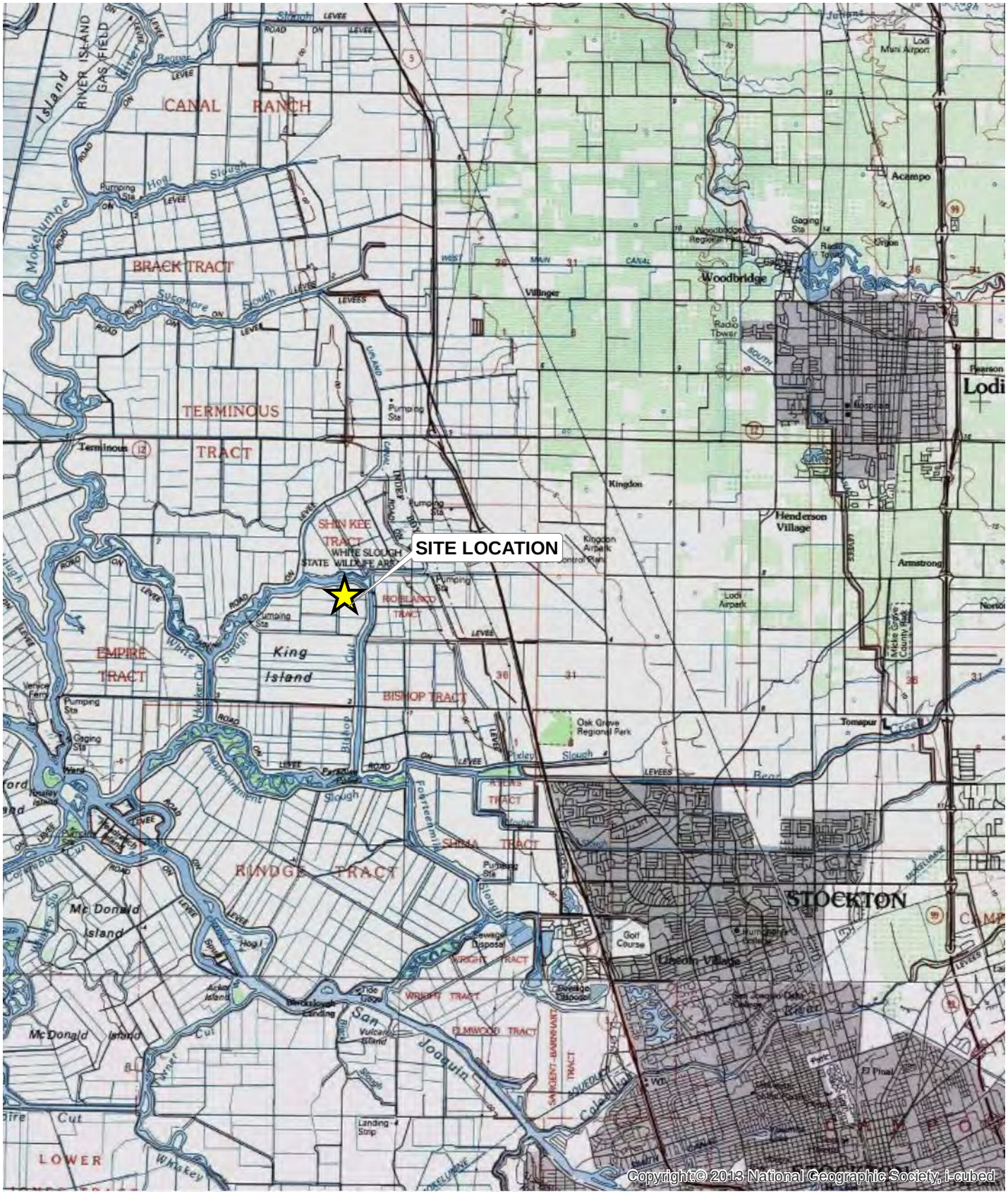
Figure F-13 Reservoir Structure Map – Top and Base of Reservoir Sands

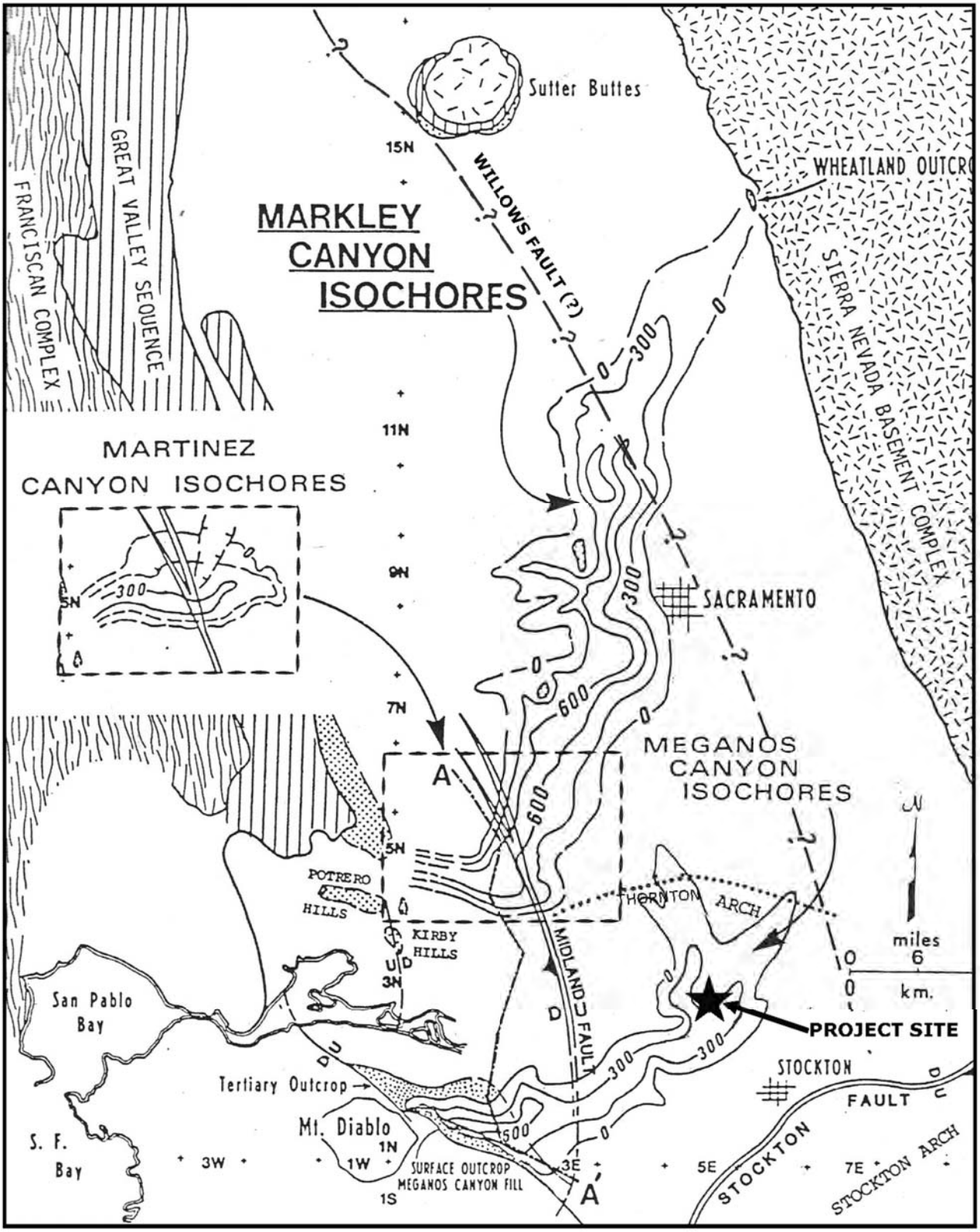


NOTE

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **PACIFIC GAS AND ELECTRIC COMPANY**	LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	DATE: 12/17/13
	TITLE: ***SITE LOCTION MAP***	FIGURE: **1**

Path: J:\GIS\WPPGE_CAES\Section\Figure 01 Site Loc Map.mxd

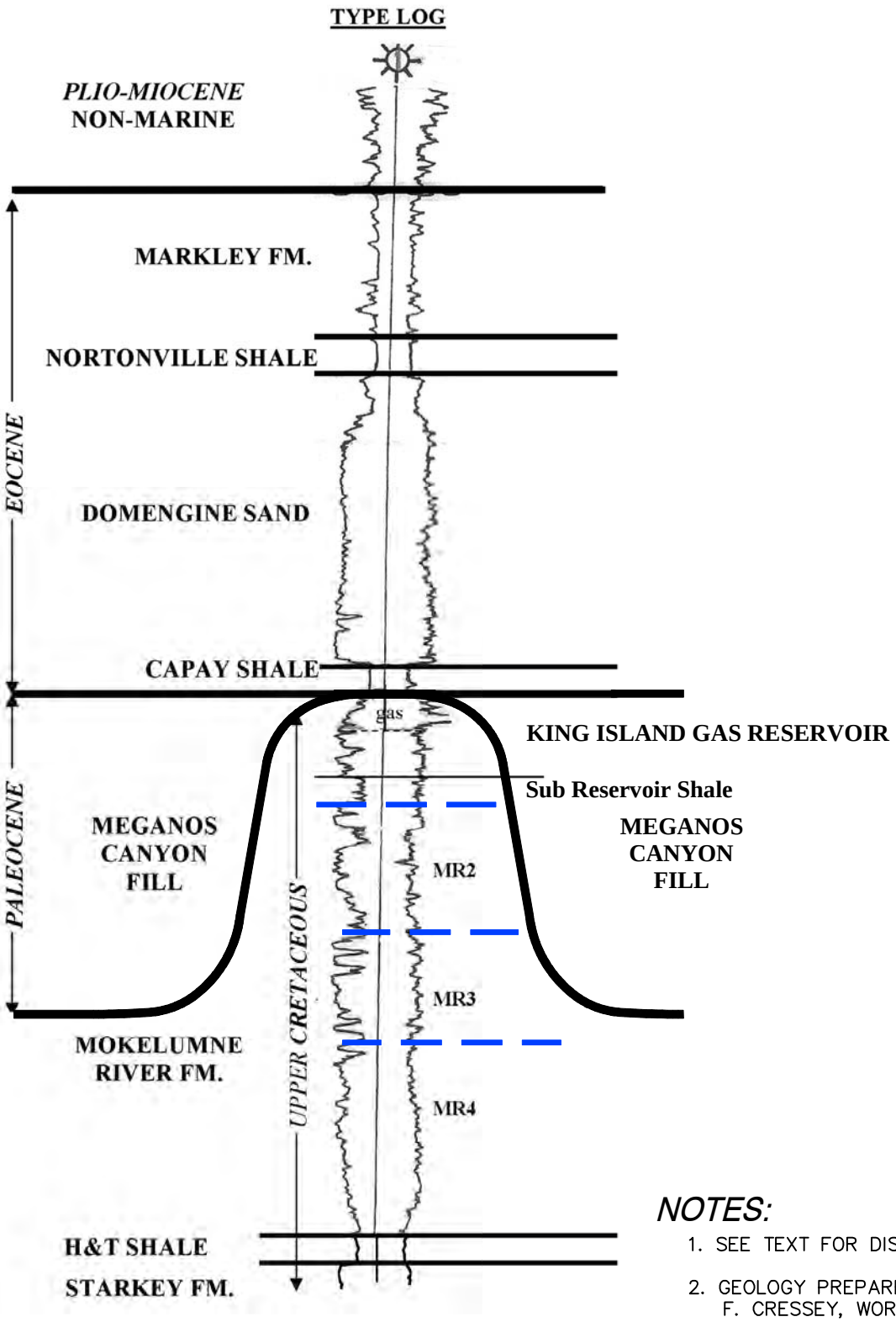


NOTES:

1. MAJOR GEOLOGICAL FEATURES, SOUTHERN SACRAMENTO VALLEY. MAP SHOWS ISOCHORES (IN METERS) OF THE MARTINEZ, MEGANOS, AND MARKLEY SUBMARINE CANYONS. PROJECT LOCATION AT KING ISLAND LIES WITHIN THE EASTERN MEGANOS CANYON AND IS SHOWN BY STAR. MAP MODIFIED FROM BEYER, 1988.
2. GEOLOGY PREPARED BY: F. CRESSEY, WORLEYPARSONS GROUP
3. FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **Pacific Gas and Electric Company**	PG&E	TITLE: *MAJOR GEOLOGIC FEATURES - SOUTHERN SACRAMENTO VALLEY*	DATE *12/13/13*
		LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	FIGURE: *F-2*

J:\GIS\WPPGE_CAES\SectionF\Figure F-02 Markley Canyon Isochores.dwg



NOTES:

1. SEE TEXT FOR DISCUSSION
2. GEOLOGY PREPARED BY:
   F. CRESSEY, WORLEYPARSONS GROUP
3. FIGURE PREPARED BY:
   JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for **Pacific Gas and Electric Company**	TITLE: *STRATIGRAPHIC COLUMN KING ISLAND GAS FIELD*	DATE *12/30/13*
	LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	FIGURE: F-3

J:\GIS\WPPGE_CAES\SectionF\Figure F-03 Stratigraphic Column.dwg

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-04 XSec Locs.mxd

Powell 1
SFEC-Mills 25-1
Powell 1
Jade Farms 1
Bingham 1
Live Oak 1-36
Merlo Estate 1
Agresources 1-32
Live Oak Investors 1-32
Stanford U. et al 1
Nard 1
Big Valley-Finkbohner 1
Harden Farms 1
Dow-Atkins Kroll 1
Brazos-Harden 1-5
Union-Brazos Cotta 1
Coldani 1
C'
Nuss 1
Core Hole Atkins Kroll 1
Joe Cotta Properties, Inc. 1
Finkbohner 1
Texaco-Georges 1
Van Exel 16-1
Sargent Slough 2
Cotta 2
Baleri 11-1
Woodbridge Unit 30-1
Lind 1
Williams 1
Domingas 1
Argo-Buttes-Coldani 2-15
Coldani Corehole 1
Ratto 14-1
Buttes-Coldani 15-44
Roventa & Kroll 1
Roventa Corp. 17-1
Stevens 16-1
M. C. Fong 1
Fong 2
Morais 16-2
Morais 16-1
Buttes-Fox 15-37
Buttes-Rio Blanco 15-77
Sargent Slough 1
Transamerica 1-19
Capital Fraser 19-1
White Slough Unit 1
Ripken 21-1
Red House Fee 65-24
B'
NCPA Stig 1
LEC 1
City of Lodi 1
Empire Tract 1
Pereira et al Unit 1
KING ISLAND 1-28
B
A'
Piacentine 1-27
Piacentine 2-27
Rio Blanco 1
Klein 1-28
Federal Imeson 1
Citizen Green 1 (Bottom Hole)
Moresco et al Unit A 1
Core Hole G. & P. 1
Empire Tract Unit 1
Rizzi 1
King Island 33-1
Piacentine 1
A
Union-Gianelli 1
Empire Tract 1
Pellegri 1-32
CPC-Hatch 31-1
Dell Aringa 1-31
McCulloch-Stefani 1
Victor Leonardini et al 1
Rocha et al Unit 1
Jackson et al 1
C
SFEC-Luckey 7-1
Shell-Allied Properties 1-8
Pacific States 1
Allied Properties 1
Zuckerman A-1
Rindge Tract 1

0 3,600 Feet

Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- CROSS SECTION LINE

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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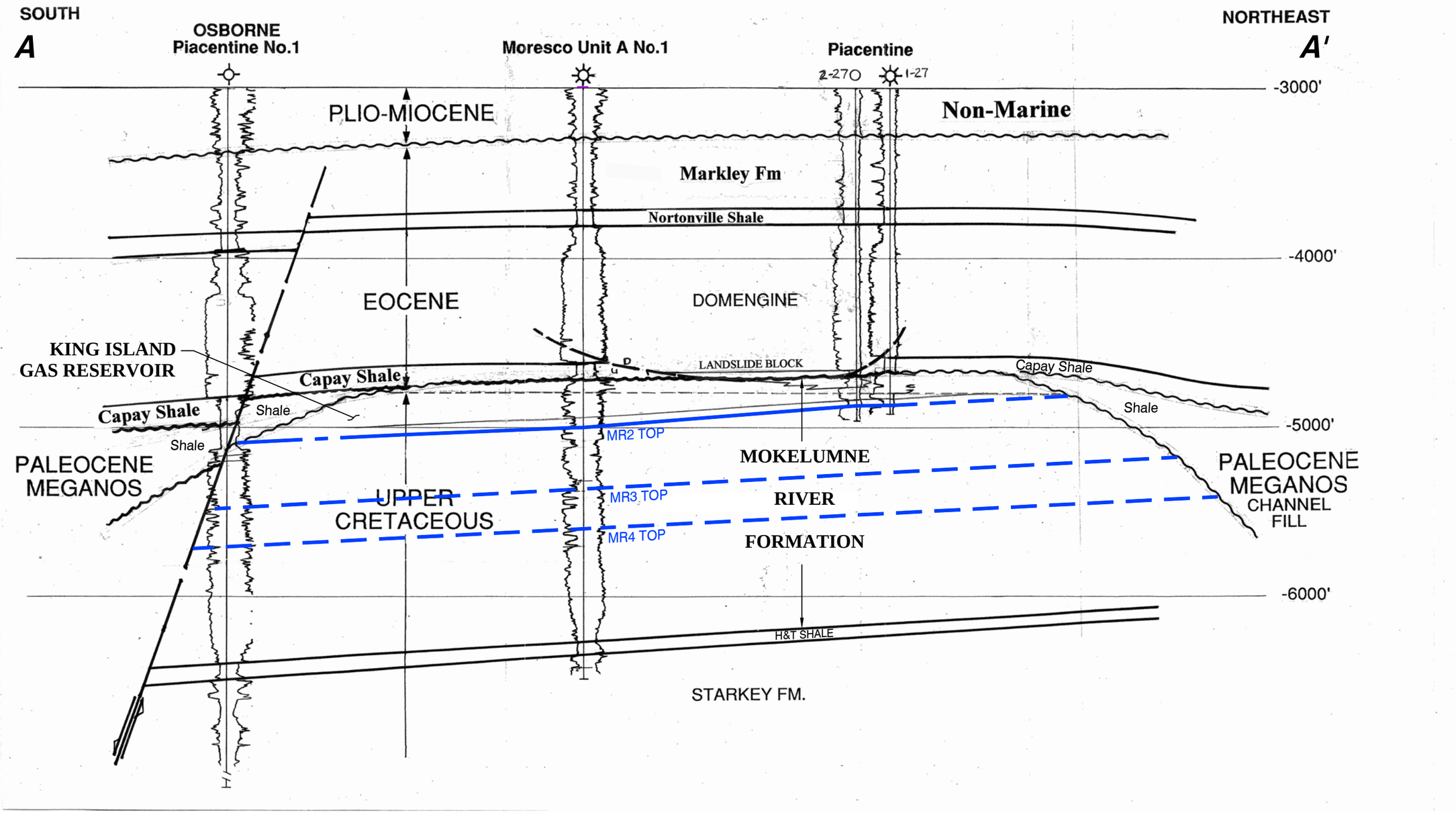
FIGURE F-4

CROSS-SECTION LOCATIONS



NOTES:

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP
TDS DATA BY J. RESOWALLI, JR & ASSOCIATES

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCAITES, INC.

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FIGURE F-5

STRUCTURE SECTION A-A'

J:\GIS\WPPGE_CAES\SectionF\Figure F-05 StrucSection A-A.dwg

B

WEST

INTERSECTION D-D'

KING ISLAND GAS FIELD

B'

EAST

API# 077-00513
UNION
Empire Tract #1
Sec. 30, T3N-R5E
1964 KB 2'

API# 077-00512
BRAZOS
Pereira et al Unit #1
Sec. 29, T3N-R5E
1961 KB 3'

API# 077-00566
EOG
Ripken #21-1
Sec. 21, T3N-R5E
1992 KB 5'

API# 077-00510
HOLMES
Klein #1-28
Sec. 28, T3N-R5E
1961 KB 10'

API# 077-20469
SIERRA RES
Moresco et al Unit A #1
Sec. 28, T3N-R5E
1985 KB 2'

API# 077-20172
GREAT BASINS
Rio Blanco #1
Sec. 27, T3N-R5E
1972 KB 6'

API# 077-00509
FEDERAL
Imeson #1
Sec. 26, T3N-R5E
1955 KB 13'

API# 077-20290
GREAT BASINS
City of Lodi #1
Sec. 24, T3N-R5E
1976 KB 17'

API# 077-20688
DIVERSITED RES
King Island #1-28
Sec. 28, T3N-R5E

Plio-Miocene Non-Marine

-2000'

Markley Fm

Nortonville Shale

-4000'

Domengine Sand

Capay Shale

EOCENE

LANDSLIDE BLOCK

KING ISLAND GAS RESERVOIR

Meganos Channel Fill

PALEOCENE

Mokelumne River Fm

H&T SHALE

-6000'

UPPER CRETACEOUS

Starkey Fm

-8000'

TD 9400'

TD 5800'

TD 5635'

TD 5703'

TD 5000'

TD 6500'

TD 7570'

TD 5450'

TD 4875'

TD 6694'

API# 077-20688
PRINCETON NAT GAS
Citizen Green #1
Sec. 27, T3N-R5E
2011 KB 12'

Vertical Exaggeration 2.5 X

NOTES:

CROSS SECTION DATA BY F. CRESSEY, WORLEYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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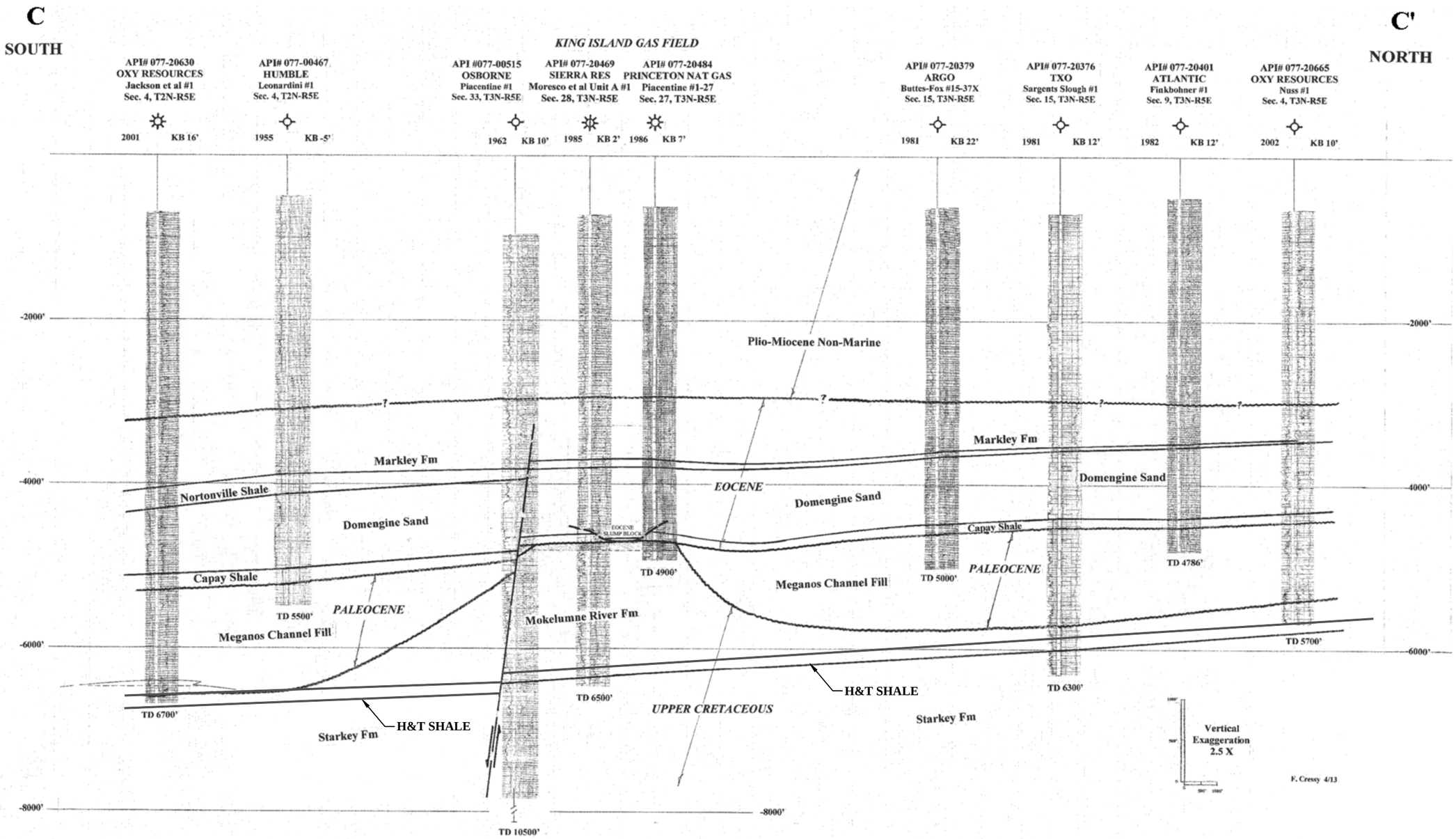
03.WP.004	12/17/13	PEM	RF

FIGURE F-6

STRUCTURE SECTION B-B'

J:\GIS\WPPGE_CAES\SectionF\Figure F-06 Section B-B.dwg



NOTES:

1. CROSS SECTION BY F. CRESSY, WORLEYPARSONS GROUP.
2. FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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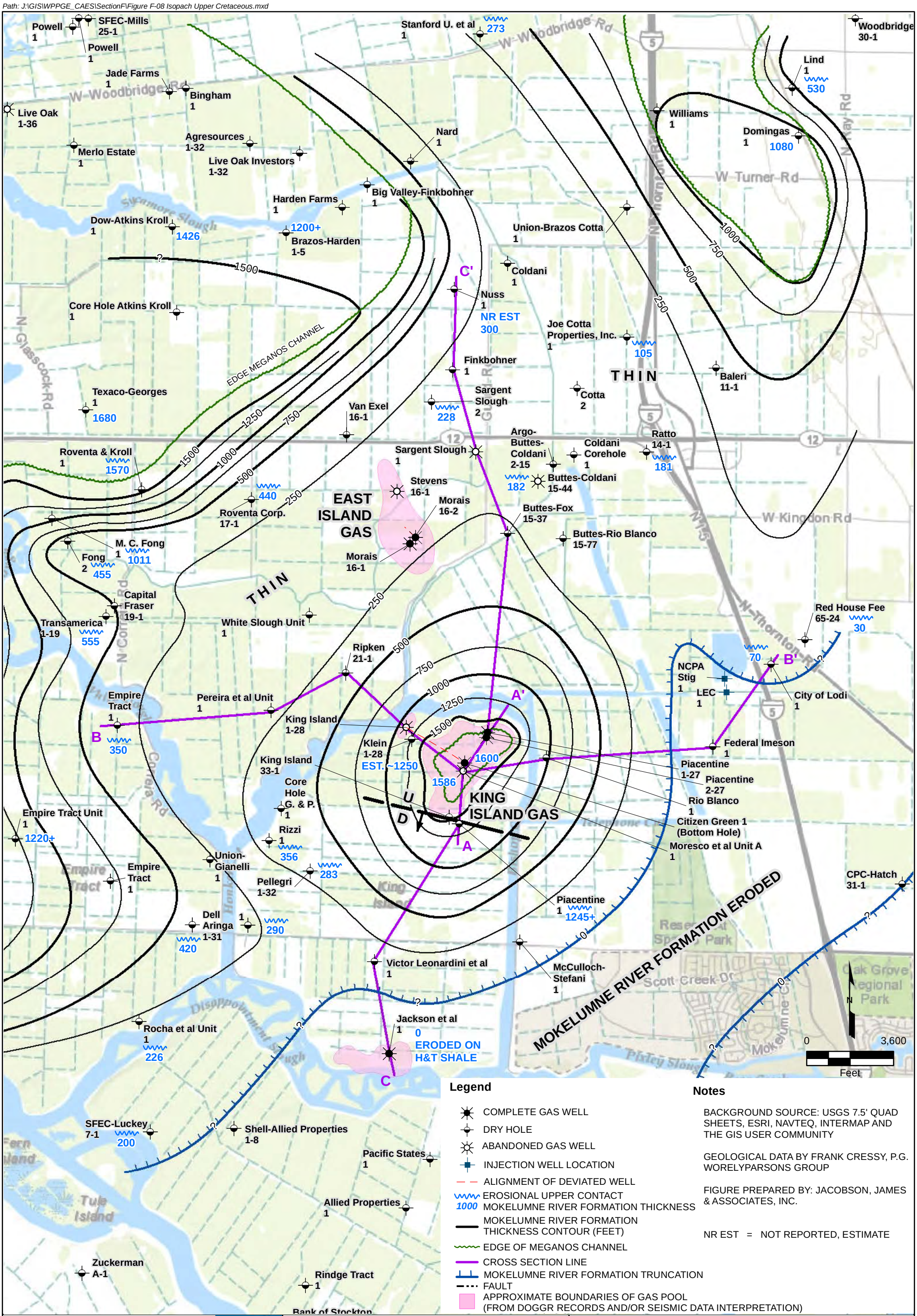
03.WP.004	12/20/13	PEM	RF

FIGURE F-7

STRUCTURE SECTION C-C'

J:\GIS\WPPGE_CAES\SectionF\Figure F-07 StrucSection C-C.dwg

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-08 Isopach Upper Cretaceous.mxd



Legend

- COMPLETE GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- ALIGNMENT OF DEVIATED WELL
- EROSIONAL UPPER CONTACT
- 1000 MOKELUMNE RIVER FORMATION THICKNESS
- MOKELUMNE RIVER FORMATION THICKNESS CONTOUR (FEET)
- EDGE OF MEGANOS CHANNEL
- CROSS SECTION LINE
- MOKELUMNE RIVER FORMATION TRUNCATION
- FAULT
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

NR EST = NOT REPORTED, ESTIMATE

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SAN JOAQUIN COUNTY, CALIFORNIA

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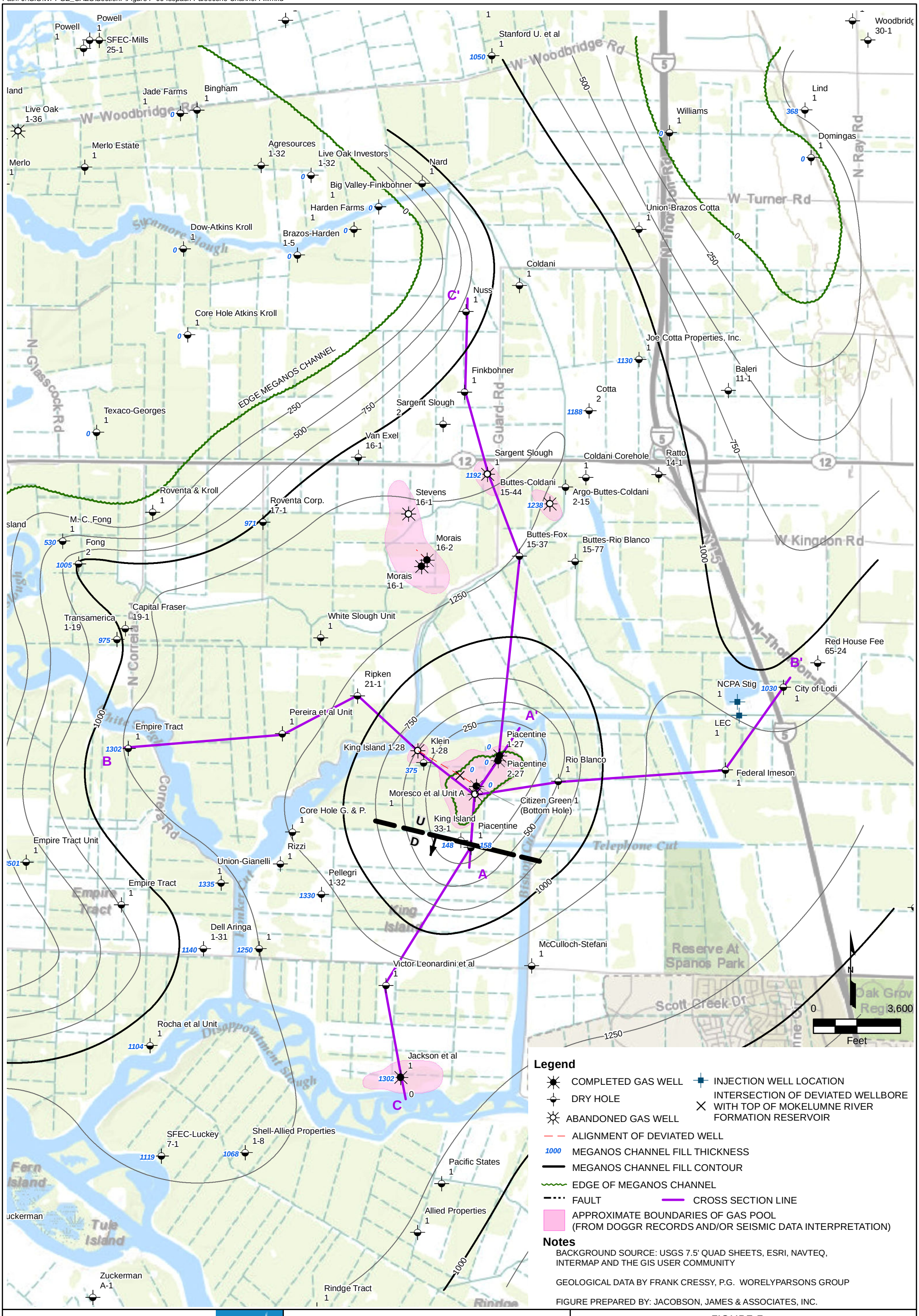
FIGURE F-8

ISOPACH MAP: UPPER CRETACEOUS MOKELUMNE RIVER FORMATION

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-09 Isopach Paleocene Channel Fill.mxd



Legend

- COMPLETED GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- INTERSECTION OF DEVIATED WELLBORE WITH TOP OF MOKELUMNE RIVER FORMATION RESERVOIR
- ALIGNMENT OF DEVIATED WELL
- 1000 MEGANOS CHANNEL FILL THICKNESS
- MEGANOS CHANNEL FILL CONTOUR
- EDGE OF MEGANOS CHANNEL
- FAULT
- CROSS SECTION LINE
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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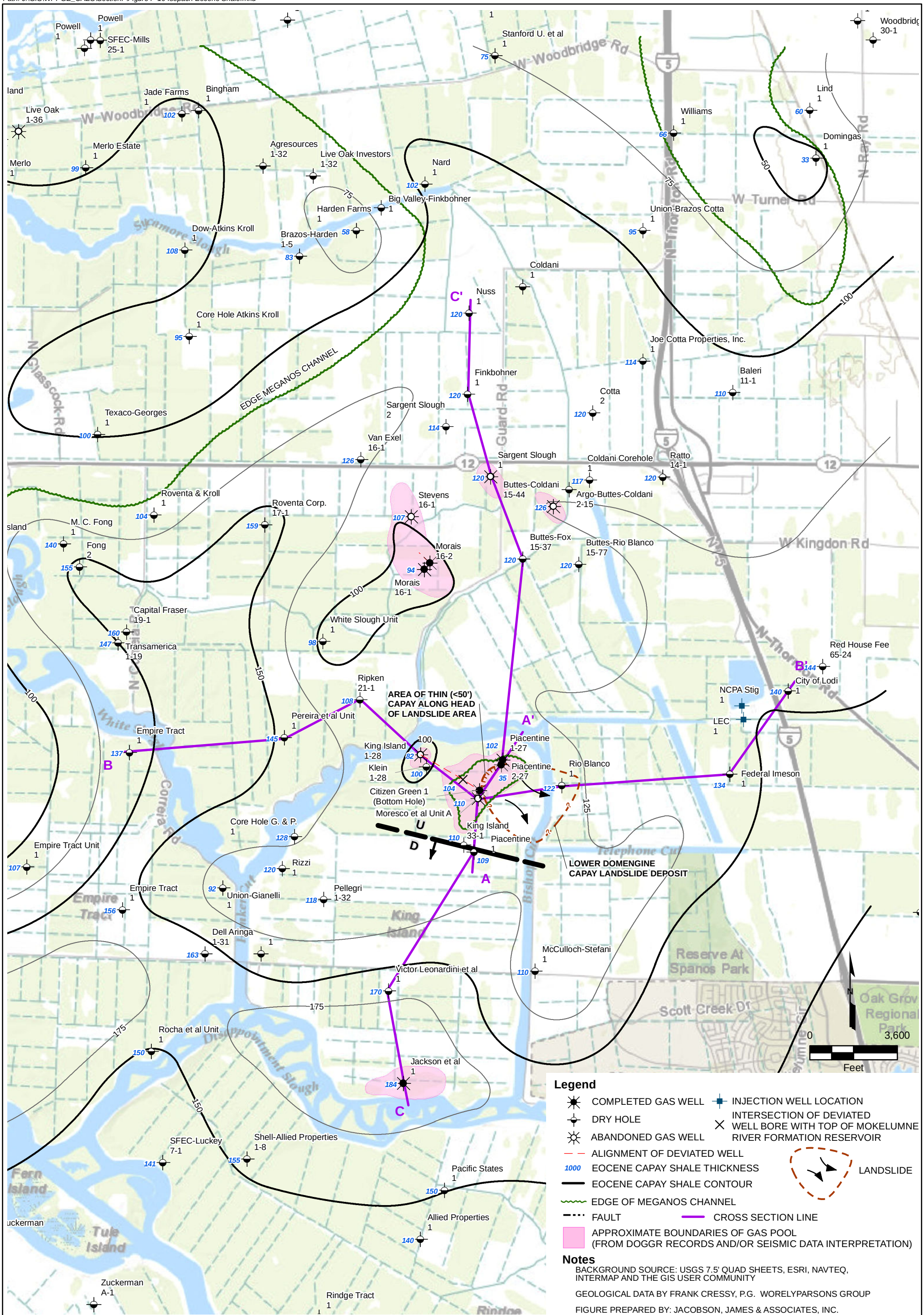
FIGURE F-9

ISOPACH MAP PALEOCENE MEGANOS CHANNEL FILL THICKNESS

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-10 Isopach Eocene Shale.mxd



Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

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SAN JOAQUIN COUNTY, CALIFORNIA

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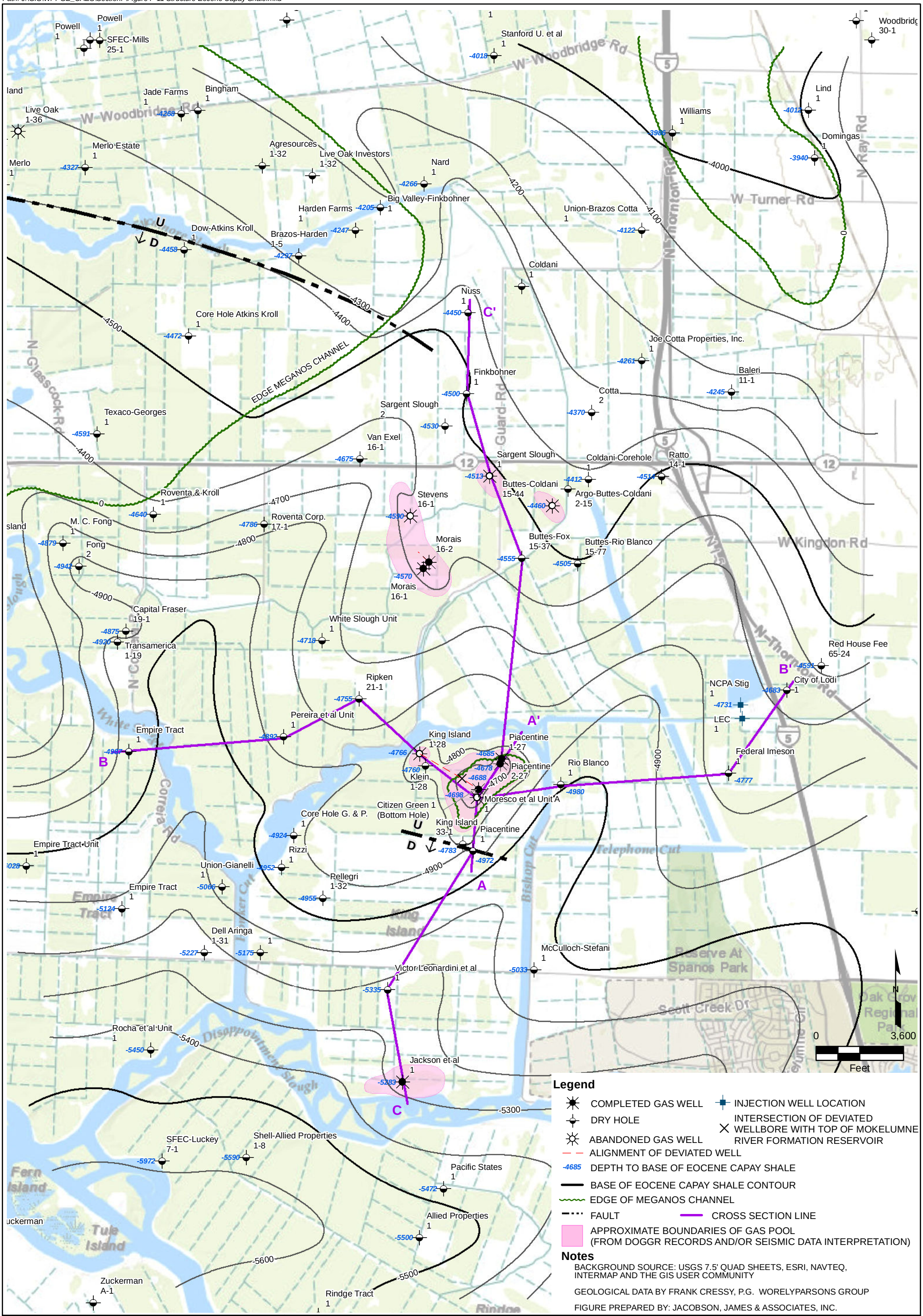
03.WP.004	04/07/14	DPG	RF

FIGURE F-10

ISOPACH MAP EOCENE CAPAY SHALE THICKNESS

Path: J:\GIS\WPPGE_CAES\SectionF\Figure F-11 Structure Eocene Capay Shale.mxd



Legend

- COMPLETED GAS WELL
- DRY HOLE
- ABANDONED GAS WELL
- INJECTION WELL LOCATION
- INTERSECTION OF DEVIATED WELLBORE WITH TOP OF MOKELUMNE RIVER FORMATION RESERVOIR
- ALIGNMENT OF DEVIATED WELL
- -4685 DEPTH TO BASE OF EOCENE CAPAY SHALE
- BASE OF EOCENE CAPAY SHALE CONTOUR
- EDGE OF MEGANOS CHANNEL
- FAULT
- CROSS SECTION LINE
- APPROXIMATE BOUNDARIES OF GAS POOL (FROM DOGGR RECORDS AND/OR SEISMIC DATA INTERPRETATION)

Notes

BACKGROUND SOURCE: USGS 7.5' QUAD SHEETS, ESRI, NAVTEQ, INTERMAP AND THE GIS USER COMMUNITY

GEOLOGICAL DATA BY FRANK CRESSY, P.G. WORELYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
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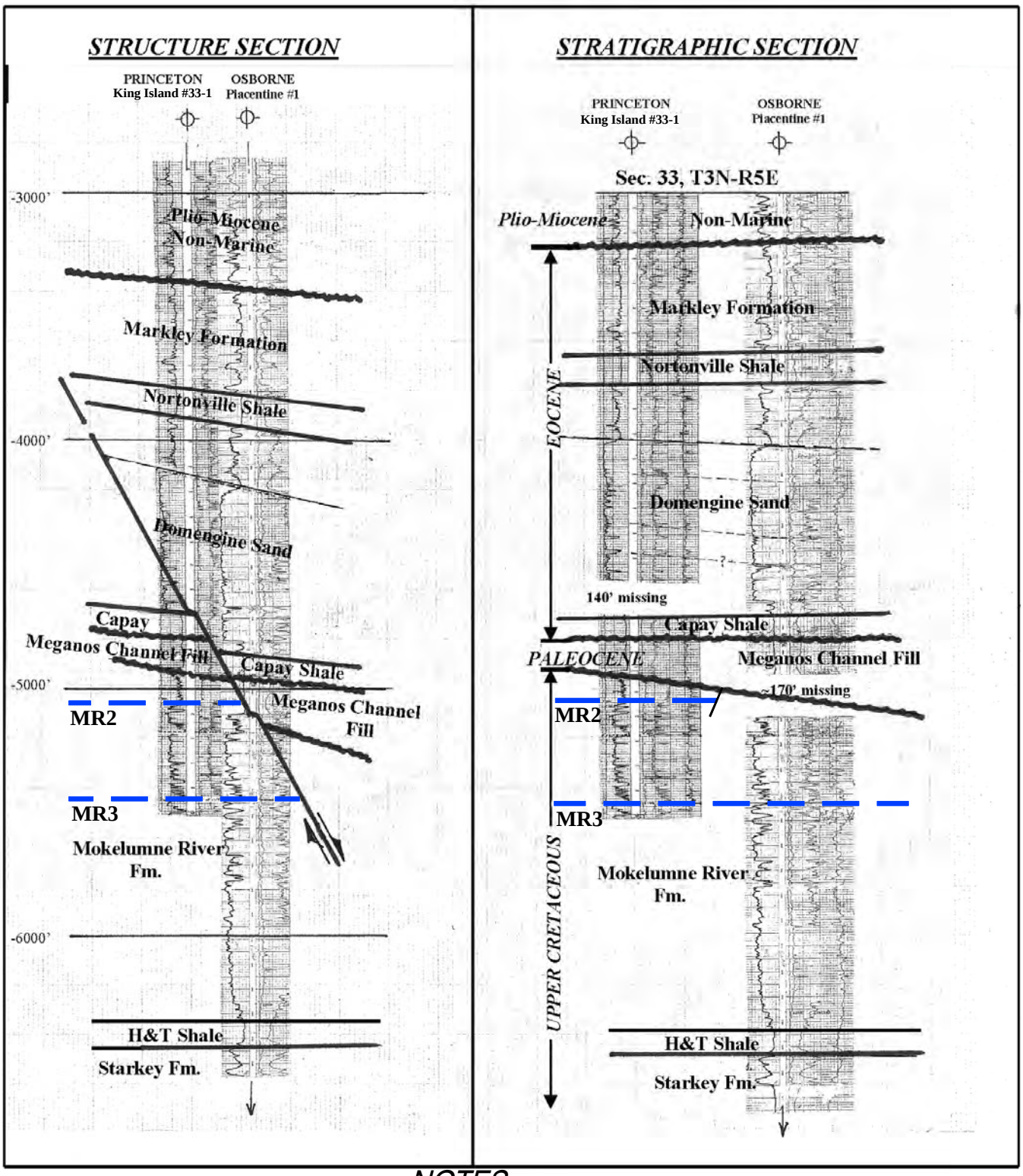
FIGURE F-11

STRUCTURE MAP SHOWING BASE OF EOCENE CAPAY SHALE

SOUTH KING ISLAND
Section 33 Fault Study



NOTES:

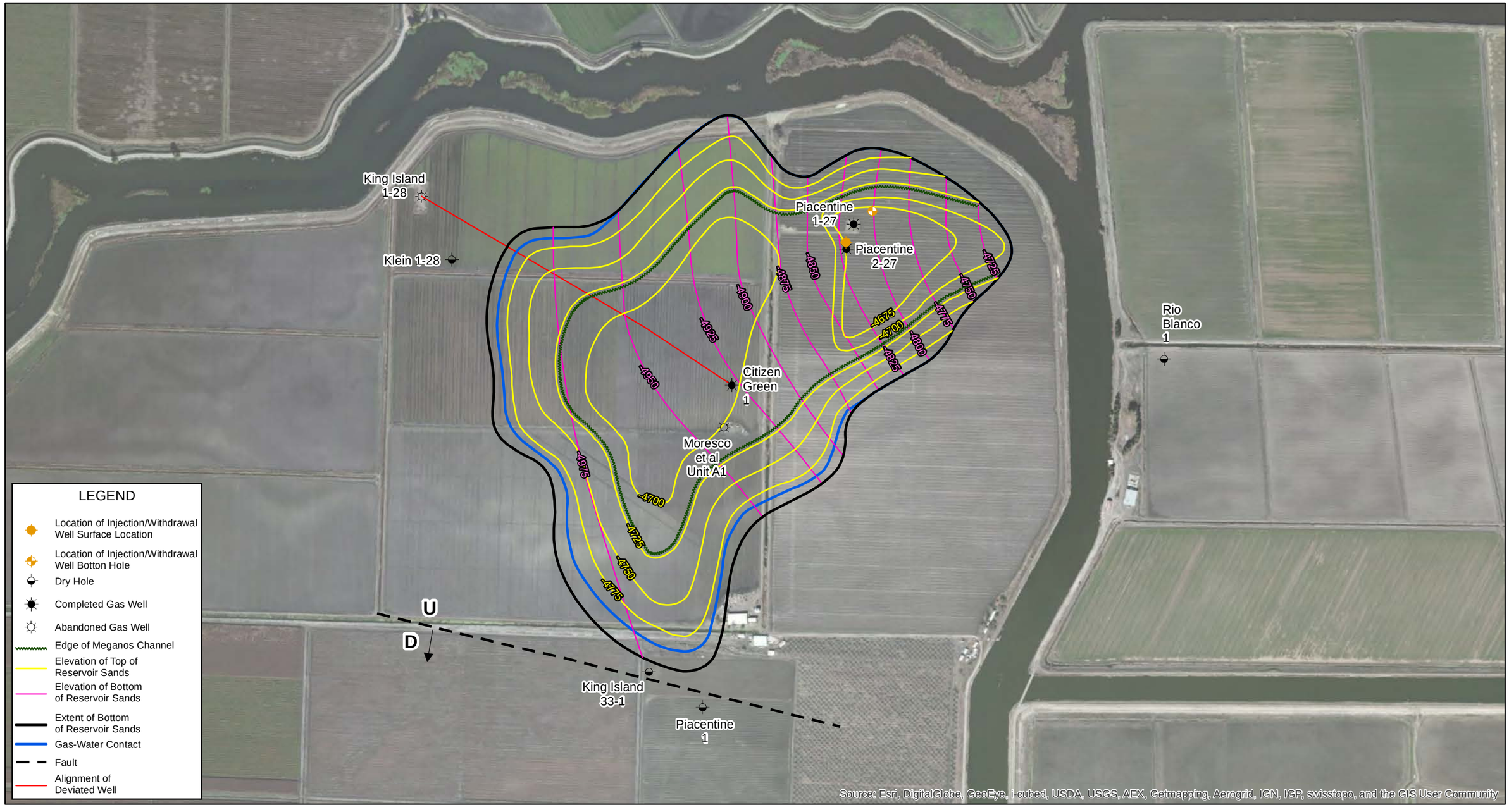
1. GEOLOGY PREPARED BY: F. CRESSEY, WORLEYPARSONS GROUP
2. FIGURE PREPARED BY: JACOBSON, JAMES & ASSOCIATES, INC.

Prepared for
Pacific Gas and Electric Company

PG&E

TITLE: *SOUTH KING ISLAND SECTION 33 FAULT STUDY*	DATE *12/30/13*
LOCATION: *PG&E CAES PROJECT COMPRESSION TESTING I/W WELL UIC APPLICATION SAN JOAQUIN COUNTY, CALIFORNIA*	FIGURE: F-12

J:\GIS\WPPGE_CAES\SectionF\Figure F-12 South King Island Sec 33 Fault Study.dwg



SOURCE:
California Department of Conservation Division of Oil, Gas and
Klein 1-28 relocated to match Well Summary Report, June 26, 1961
Structural data provided by Douglas Imperato, Ph.D, 12/09/13.
Water Wells from CA DWR. All locations approximate.

N
W E
S
0 750
Feet

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SAN JOAQUIN COUNTY, CALIFORNIA

Pacific Gas and Electric Company

RESERVOIR STRUCTURE MAP
TOP AND BASE OF RESERVOIR SANDS

SWL	RF	12/31/2013
108010-00365		**F-13**

ATTACHMENT G

Geological Data on Injection and Confining Zones

CONTENTS

Section G.1 Regional Geologic Setting

Section G.2 Stratigraphy

Section G.3 Structure

Section G.4 Target Injection Zone

Section G.5 Confining Zones

Section G.6 References

Table G-1 Average Ambient and Stress Porosity and Horizontal Permeability, Mokelumne River Formation Reservoir Sands

Table G-2 Vertical-Horizontal Anisotropy Permeability Anisotropy Ratio, Mokelumne River Formation Reservoir

Table G-3 Vertical Permeability, Mokelumne River Formation Clay-Silt-Sand Layers

Table G-4 Effective Porosity and Permeability, Mokelumne River Formation Sands

Table G-5 Depth Discrete Pressure Data, Piacentine 2-27 RDT Log

Table G-6 Permeability of Capay Shale

Graph 1 Mokelumne River Formation Reservoir Porosity-Permeability Cross-plot

Graph 2 Mokelumne River Formation Reservoir Vertical vs. Horizontal Permeability Cross-plot

Attachment G-1 Piacentine 2-27 Core Analysis Reports

Attachment G-2 Morais 16-2 Porosity-Permeability Core Analysis Report and Tabulated Averages

Attachment G-3 Bottomhole Pressure Calculations for Piacentine #1-27 and King Island #1-28

Attachment G-4 Gas or Water Production in Moresco et. Al Unit A-1

G.1 REGIONAL GEOLOGIC SETTING

The King Island gas reservoir is located in northern San Joaquin County between the cities of Stockton and Sacramento, and lies within the northern third of the Great Valley geomorphic province of California (Figure F-1). The Great Valley is an asymmetrical structural trough with a steep west flank and a more gently dipping east flank. It is situated between the Coast Ranges to the west and the Sierra Nevada Range to the east and includes the San Joaquin Valley to the south and the Sacramento Valley to the north. The eastern flank of the southern Sacramento Valley, where the King Island Gas Field is located, is underlain at depth by a basement complex of relatively impermeable metamorphic and crystalline plutonic rocks. These are overlain by marine sedimentary rocks, followed by non-marine volcanic and alluvial deposits derived from the coast range to the west and the Sierra Nevada to the east (Edmondson, W.F. and others, 1967).

During much of the Cretaceous and early Tertiary Period, an ancient sea covered what is now the San Joaquin Valley. A fore-arc basin was located west of the volcanic arc that developed into the Sierra Nevada and east of a deep sea trench complex where the oceanic crust was pulled (subducted) beneath the continental margin of the North American Plate. These rocks were subsequently uplifted to form the Coast Range. Sediment transported in rivers that flowed down from the ancestral Sierra Nevada was deposited as gravels, sand, and clay on the sea floor. Over time, more than 15,000 feet of sediments accumulated. Eventually, these sediments were compacted and formed the marine sandstones, siltstones, and shales found deep beneath the valley. Depositional sequences were typically laid down during times when sea levels rose or the basin subsided (transgressions), and then eroded during times of relative sea level falls or basin uplift (regressions). Four distinct Tertiary age submarine canyons developed during uplift cycles in the valley and were filled in with transgressional marine sequences during times of subsidence and relative sea level rise (Harwood, D.S. and Helley, E.J., 1987). The King Island Gas Field is an erosional remnant within the Meganos submarine canyon complex (also called Meganos Channel) that was eroded and filled during Paleocene time (Figure F-2).

Marine sedimentary sequences in the Sacramento and northern San Joaquin Valley include organic shales that serve both as source rocks for natural gas and, by virtue of their low permeability, as seals or cap rocks for gas accumulations in permeable sandstones reservoirs. Petroleum is generally not found in the Sacramento and northern San Joaquin Valley, but natural gas fields have been extensively developed, including the subject field. Groundwater contained within these marine formations is generally too saline to serve as a potable water supply, except in some shallow locations along the basin edges where salts have been flushed from the rocks by fresh water recharge over geologic time.

The Upper Cretaceous and Eocene marine sedimentary sequences in the Sacramento and northern San Joaquin Basin are overlain by Miocene to Recent alluvial and lacustrine sediments and local volcanic deposits. The alluvial and lacustrine deposits consist of complexly interbedded sands, silts, and clays, and contain the freshwater aquifers of the area.

G.2 STRATIGRAPHY

The stratigraphy underling the vicinity of the King Island Gas Field is described below and shown on the accompanying stratigraphic column (Figure F-3) and graphically on several cross sections. The locations of regional cross sections A-A', B-B' and C-C' are shown on Figure F-4 and the cross sections are presented as Figures F-5 through F-7, respectively. The log correlations and regional formation markers upon which the cross sections are based are in accordance with the regional stratigraphic framework presented in Edmondson, W.F. and others (1967).

The deepest well in the immediate vicinity of the King Island Gas Field is the Osborne "Piacentine" #1 (Sec. 28, T3N-R5E), which was drilled to a total depth of 10,500 feet into Upper Cretaceous E-zone Winters Formation shale, which is interpreted as a marine slope facies deposit. Deep-water sandstones of equivalent age, and also belonging to the Winters Formation, lie westward of the Osborne well. Based on regional studies (Edmondson, W.F. and others, 1967; California Division of Oil and Gas, 1982), there is an estimated 5,000 feet of older Upper Cretaceous sediments that lie below the maximum depth of the Osborne well and above the Sierran crystalline plutonic and metamorphic basement rocks.

Overlying the Winters Formation shale is a 1,650-feet thick sequence of sandstones and shale belonging to the shallow marine Starkey Formation sands that are, in part, age equivalent to the deep-water, basinal Winters Formation sandstones. A 100+ foot thick mudstone and claystone unit, referred to as the H&T Shale regionally overlies the Starkey Formation. Overlying the H&T Shale are Upper Cretaceous fluvial-deltaic sediments of the Mokelumne River Formation. The Mokelumne River Formation reaches nearly 1,600 feet in thickness and is composed predominately of thick interbedded, fluvial-deltaic sandstones with thin interbeds of siltstones, mudstones and shale (Figure F-8). Minor lignite is also present. Several successions of thin marine flooding events within the formation are represented by widespread shale beds that allow good intra-formational correlations. Complete sections of the Mokelumne River Formation are present in the Moresco # A-1 well (Sec. 28, T3N-R5E), the discovery well of the King Island Gas Field, and the Citizen Green # 1 well (Sec. 28, T3N-R5E) (Figure F-3). Sands in the uppermost 240 feet of the Mokelumne River Formation provided the reservoir for the gas accumulation at King Island.

During the Paleocene, sea level fell and the Mokelumne River Formation was deeply eroded by the Paleocene Meganos Channel. As much as 1,300 feet of the Mokelumne River Formation was eroded on all sides of King Island, and in the deepest portions of the channel to the southeast of King Island, the entire Mokelumne River section was eroded (Figure F-8). A rising sea level caused the erosional valley to be subsequently filled by late Paleocene Meganos Formation marine sandstones, siltstones and shales. The channel-fill sediments were complexly deposited, but in general, thick sandstones are more common to the north of King Island and lie near the axis of the channel arms. Based on review of available well logs, shaley sediments nearly completely fill the channel to the south of King Island and generally occur along the channel margins in the sandier areas. Porosity and permeability analyses performed on core plugs from a conventional core collected in April 2013 in the Meganos Channel Formation gas reservoir sand in the Morais #16-2 core well at East Islands (located approximately 1.4

miles to the north of the King Island gas field), yielded average porosity and permeability values at confining stress of 2700 psi of 30% and 1,771 mD, respectively (Attachment G-2). These porosity and permeability values are considered generally representative for the Meganos Channel fill sands in the vicinity of King Island.

The Mokelumne River Formation at King Island remained as a large erosional remnant or island between two erosional arms of the Meganos Channel system. Meganos Channel fill sediments were not encountered in the four wells (Piacentine 1-27, Piacentine 2-27, Moresco et al Unit #1, and the Citizen Green #1) in the King Island Gas Field. Five wells that lie immediately off the flanks of the field (Rio Blanco #1, Klein #1-28, King Island #1-28, King Island #1-33, and Piacentine #1) encountered varying thicknesses of primarily shaley Meganos Channel fill sediments, with a maximum of 450 feet penetrated in the Rio Blanco #1 (Figure F-6). The Piacentine #1, King Island #1-33 and the Klein #1-28 penetrate a thin sequence of Meganos Channel fill near the edges of the channel before entering Mokelumne River Formation sands that are stratigraphically below the Mokelumne River Formation sands in which the King Island gas pool occurred. The King Island #1-28 and the Rio Blanco #1 reached total depth in the Meganos Channel fill. The interpretation of the contact between the Meganos Channel and the Mokelumne River Formation in the vicinity of the King Island gas field is based on well log correlations and 3D seismic data interpretation. In particular, the laterally continuous Mokelumne River Formation sand packages are readily recognized on electric logs and correlated between wells in the area of the King Island gas field. In contrast, sands within the Meganos Channel fill are more lenticular and discontinuous.

Mokelumne River Formation sediments and the younger Meganos Channel fill sediments are unconformably overlain by the Eocene-age Capay Shale, a regional marine mudstone that is present under much of the central and southern Sacramento basin north of the Stockton fault (Figure F-2). The unit ranges in thickness between 90 and 120 feet in the vicinity of King Island as evidenced by the logs of nine wells located in and immediately adjacent to the King Island Gas Field (logs for these wells are included in Attachment C). The unit is thicker where it overlies thick intervals of Meganos Channel fill sediments (Figure F-10). This unit forms the seal or cap rock for gas trapped in the uppermost Mokelumne River Formation sands at King Island, as well as numerous other gas fields in the southern Sacramento Valley. The Capay is composed of thick gray-green silty mudstones and forms an excellent impermeable seal over the gas reservoir. The basal Capay contains abundant glauconite over a thin basal conglomeratic zone.

The Eocene-age Domengine Formation sandstone conformably overlies the Capay Shale. These sands were deposited in a shallow-water, marine environment. The Domengine Formation is nearly 800 feet thick and is composed predominately of well-sorted, clean quartzose sandstone with thin interbeds of gray siltstone and claystone. Minor lignite is also present. The Domengine sandstone is conformably overlain by the Nortonville shale, another regional marine shale unit that reaches thicknesses between 100 and 200 feet in the vicinity of King Island. The late Eocene-age Markley Formation overlies the

Nortonville Shale, possibly as an unconformable surface. At King Island, it consists of 200 to 300 feet of interbedded marine mudstone, siltstone, and sandstone.

Over 3,000 feet of non-marine sediments unconformably overlie the Eocene sediments and represent the final stages of the basin filling. These sediments range in age from Miocene through the Pliocene and are capped by several hundred feet of Pleistocene to Recent alluvial and lacustrine sediments. These sediments and the groundwater resources contained within them are further described in Attachment E.

G.3 STRUCTURE

The general structure of the Upper Cretaceous formations (Starkey, H&T and Mokelumne River) is a homocline dipping from approximately 2° to 6° to the southwest, based on regional seismic data, well control, and sparse dipmeter data (Figure F-11). The structure of the Eocene formations (Capay, Domengine, Nortonville, and Markley) overlying the Mokelumne River Formation is complicated by the presence of the underlying Paleocene-age Meganos Channel, which eroded as much as 1,600 feet of the Mokelumne River Formation (Figure F-9). Subsequent filling of this large submarine canyon by varying amounts of sandstone and shale resulted in an undulating base Capay surface due to differential compaction of Meganos Formation shales near channel edges, around the perimeter of the large erosional "island" at King Island, and over thick sandstone channels within the Meganos Channel fill sediments (Figure F-11). The resultant compaction-related synclines and anticlines are superimposed on the regional homoclinal pattern. The Capay shale is thicker over the erosional arms of the Meganos Channel to the east and west of King Island (>150 feet thick), and thinner over King Island where Meganos Channel fill onlaps the Mokelumne River Formation (mostly from 90-120 feet thick; Figure F-10). Younger Eocene formations progressively show less influence of the Meganos Channel shale compaction.

The project location regionally lies on the west-dipping homocline between two cross-valley arches, the Thornton Arch, 12 miles to the north, and the Stockton Arch (and Fault), located 14 miles to the south. These and other nearby structural features are shown on Figure F-2, based on a map modified from Beyer (1988). In an east-west direction, the project location lies equidistant between the Midland Fault, located approximately 12 miles to the west, and the Willows Fault, whose inferred location is approximately 12 miles to the east (Figure F-2). The Stockton and Midland faults are major subsurface faults that were active during the Late Cretaceous through the Eocene. Movement ceased on the Midland Fault prior to the filling of the Oligocene Markley Canyon (Pepper, Miles W. and Dane S. Johnson, 1992) and any significant movement on the Stockton Fault occurred prior to the Eocene (Sterling, Robert. H. Jr., 1992). Harwood and Helley (1987) postulated that the Willows Fault, well documented in the northern Sacramento Valley, extends into the southern Sacramento Valley, trending just to the east of the cities of Sacramento and Stockton. The inferred presence of the fault was based on an abrupt steepening to the west of basement contours at the -1500 meter contour level. Although late Cenozoic movement has been documented on the Willows fault in the northern Sacramento Valley,

no displacement has been determined on the projected segment between Sacramento and Stockton. It has been postulated that this inferred segment of the Willows Fault separates oceanic crust (ophiolitic basement) to the west from Sierran granitic basement to the east. However, subsurface data does not support this interpretation. Although several wells penetrated gabbroic basement west of the fault, other wells encountered Sierran-type basement. Harwood and Helley (1987) noted granite and schist in two well south of Sacramento, quartz diorite was noted near Stockton under the Stockton gas field, and a well approximately 13 miles south-southwest of the project location (and approximately 12 miles west of Stockton) encountered quartzite at total depth. Most likely, basement rocks under King Island are a Sierran-type basement similar to those that border the Sacramento Valley to the east. Wong (1992) describes them as "... a steeply-dipping belt of late-Paleozoic to mid-Mesozoic metamorphosed volcanic and sedimentary rocks which have been intruded by basic to ultrabasic rocks of similar age. Granitic plutons of Jurassic to Cretaceous age have later intruded the entire sequence."

Major regional faults are not known to be present near the site, but a small southwest-dipping normal fault has been mapped immediately south of the King Island Gas Field in Section 33, T3N-R5E. The fault has a displacement of about 150 feet and appears to cut out Meganos Channel shales in the Piacentine #1 well and basal Domengine sand in the King Island #1-33 well (Figure F-12). Seismic reflection data suggests that the Miocene non-marine sediments have not been offset by this fault, and therefore that movement ceased on this fault prior to their deposition. This interpretation is also supported by correlation of well logs for the wells in and near King Island, which suggests the fault displaces the Nortonville Shale and was active during deposition of the Eocene-age Markley Formation, but does not displace the overlying Plio-Miocene sediments (Figure F-5). A possible fault, similar to the one that cuts the King Island #1-33 and the Piacentine #1, occurs 4 to 5 miles north-northwest of the King Island gas field (Figure F-11). The fault is based on a contouring anomaly on the relatively uniform, southwest-dipping homoclinal structure at the base Eocene Capay Shale, and on approximately 75 feet of missing Mokelumne River Formation section in the Dow Atkins-Kroll #1, located in Section 6, T3N, R5E, just south of Sycamore Slough, approximately 4.6 miles to the northwest of the King Island gas field (Figures F-4 and F-11). The fault is interpreted to be down-thrown to the south-southwest. Movement on these two faults is most likely related to the same Eocene age tectonic activity that formed the Midland fault. Gas field summaries by the California Department of Oil, Gas, and Geothermal Resources in the southern Sacramento Valley show that faulting in fields near the project area (West Thornton-Walnut Grove, McDonald Island, etc.) does not cut Miocene and younger sediments overlying the Eocene formations.

An offset that cuts out 60 feet of Capay Shale in the Piacentine 2-27 and a similar amount of section in the overlying lower part of the Domengine Sand in the Piacentine 1-27 was mapped in the field. However, the underlying Mokelumne River Formation appears unfaulted and there is no offset of stratigraphy near the original gas/water contact in the gas reservoir as determined from the well logs. This suggests that the offset represents an ancient (Eocene) submarine landslide on the eastern side of the King Island Gas Field (Figures F-6 and F-10). On this flank, the Rio Blanco 1 well encountered nearly 70 feet of an anomalous sandy shale interval at the top Capay Shale that is interpreted as the landslide

deposit. The Piacentine 1-27 and 2-27 wells lie near the head of the paleo-landslide, and the Rio Blanco well lies at its depositional toe. Sediment loading during early deposition of the Domengine Formation is believed to have triggered a glide plane failure in the underlying Capay Shale which slid a section of Capay and lower Domengine to the southeast towards the axis of the Meganos Channel. Such glide plane failures can occur at relatively low angles in shales. Based upon 3-D seismic data interpretation, deeper Mokelumne River and Starkey horizons, as well as shallower horizons, are not broken, suggesting the fault is limited to the Capay and basal Domengine Formation. Since the landslide "soled-out" in the Capay shale, the underlying, more competent, Mokelumne River Formation was not cut or displaced.

G.4 TARGET INJECTION ZONE

The proposed target injection zone consists of the gas-depleted (i.e., water invaded) sands of the Upper Cretaceous Mokelumne River Formation in the King Island Gas Field (Figure F-5, Figure F-13). The field has produced over 10.5 billion cubic feet of natural gas from three wells since it was discovered in 1985. Four wells have penetrated the gas pool, the Piacentine #1-27, Piacentine #2-27 (PGE's core-well), Moresco #1 and the Citizen-Green #1 (Figure F-13). Two of the wells, the Citizen-Green #1 and the Piacentine 1-27, are producing small volumes of gas.

The fluvial sands of the Mokelumne River Formation from the base of the Capay Shale to the top of the H&T Shale) attain a maximum thickness of 1,600 feet in the King Island field (Figure 8). The total formation thins in an elliptical pattern away from the King Island gas field due to down-cutting of the Meganos Channel around the Mokelumne River erosional remnant. The Mokelumne River Formation has been sub-divided into individual sand packages separated by thin (typically 50 feet or less) correlative lower permeability siltstone and shale units, as shown on the type log in the stratigraphic column (Figure F-3). As demonstrated on the type log, the lowermost part of the Mokelumne River Formation is a coarsening-upward clastic sequence with porosity and permeability decreasing with depth.

Historical gas production data from the King Island gas field (Attachments A-1 and C-1) indicates that the gas reservoir at the top of the Mokelumne River Formation stratigraphic section is in attenuated hydraulic communication with aquifers in the underlying sand packages. As such, the entire permeable section of the Mokelumne River Formation at the King Island erosional remnant should be considered as part of the injection zone for the purpose of this permit application.

The King Island gas reservoir occurs in the uppermost sand package beneath the Capay Shale and ranges in gross thickness from approximately 130 to 245 feet (65 to 175 feet net sand thickness). The large range in gross thickness is a reflection of the domal erosional contact with the overlying Capay Shale. Around the perimeter of the erosional high, the gas reservoir thins rapidly to zero due the erosion by the Meganos Channel along the flanks of the erosional high. The gas accumulation, with up to 112 feet of net pay, is sealed at the top by the Capay shale and on all four sides by Meganos Channel fill that is comprised mostly of shale (Figures F-5, F-6 and F-7) along the Channel margins.

Average porosity and horizontal permeability of the reservoir sands, based on laboratory analysis of core collected in the Piacentine 2-27, is 31% and 807 mD, respectively (Table G-1). The permeability value of 807 mD is based on an average of 162 horizontal permeability measurements at ambient stress (250 psi), corrected to confining stress of 2700 psi based on the average ratio of ambient to stress permeability of 0.282 (Table G-1). There is a reasonably good porosity-permeability relationship (correlation coefficient of 0.77) based on a cross-plot of 162 porosity and permeability analyses of core plugs from the conventional core collected from the Piacentine 2-27 core well (Graph G-1; Attachment G-1). Vertical permeability of Mokelumne River Formation reservoir sands ranged from 278 to 17,855 mD, and the average vertical to horizontal permeability anisotropy ratio is 0.80 (Table G-2). A cross-plot of vertical and horizontal permeability measurements indicates a good correlation coefficient of 0.94 (Graph G-2).

Two approaches were used to derive the average vertical permeability of low permeability sediments considered representative of the mixed clay-silt-sand layers separating Mokelumne River Formation sand packages. The first approach took the harmonic mean of three vertical permeability measurements taken at, or corrected to, confining stress: one from the Capay Shale above the Mokelumne River Formation reservoir (0.4 mD), one from a thin sand-silt layer in the upper, mostly "shaled-out", unit of the reservoir in the Piacentine #2-27 (78.3 mD), and one from a shaley-silty sand in the lower unit of the reservoir (142.6 mD). The harmonic mean vertical permeability derived using the first approach was 1.3 mD (Table G-3). The second approach took the harmonic mean of 86 horizontal permeability measurements in lower permeability sediments comprising the Capay Shale plus the upper mostly shaled-out reservoir unit, corrected to stress conditions using the average ratio of ambient to stress permeability of 0.282 (Table G-1), and then corrected to vertical permeability using the average vertical to horizontal permeability anisotropy ratio of 0.80 (Table G-2). The harmonic mean vertical permeability derived using the second approach was 0.06 mD (Table G-3). These two vertical permeability estimates are considered to bracket the expected range of vertical permeability in lower permeability layers in the Mokelumne River Formation.

The sequence that lies directly beneath the thin siltstone/shale unit that underlies the King Island gas reservoir has been designated as MR-2, and is approximately 390 feet thick. The MR-2 comprises two distinct sand packages: a thinner lower porosity/permeability package designated the Upper MR-2 underlain by a thicker higher porosity-permeability package designated the Lower MR-2. The Upper MR-2 includes a sand package from 70-75 feet thick (approximately 45 feet net sand) underlain by a clay-silt-sand layer from 35 to 40 feet thick. The Lower MR-2 includes a sand package from 210 to 220 feet thick (approximately 177 feet net sand) underlain by a clay-silt-sand layer from 60 to 70 feet thick. Weighted average porosity and horizontal permeability of MR-2 sands were derived based on the neutron-density porosity curve in the Citizen-Green #1 and a porosity/permeability relationship from the Piacentine #2-27 core analysis (Attachment C-2 and Graph G-1). For the Upper MR-2 sands, average porosity is 29% and average horizontal stress permeability is 103 mD. For Lower MR-2 sands, average porosity is 33% and average horizontal stress permeability is 632 mD (Table G-4).

The MR-3 sequence is approximately 300 feet thick (approximately 164 feet net sand) and sands have an average porosity and horizontal stress permeability of 28% and 10 mD, respectively (Table G-4). Sands within the upper approximately 320 feet of the MR-4 sequence have an average porosity and horizontal stress permeability of 30% and 19 mD, respectively (Table G-4). The lower approximately 300 feet interval of the MR-4 comprises a thinly-bedded and low permeability clay-silt-sand sequence that fines downward and has a gradational contact with the underlying H&T Shale.

The structure of the King Island Gas Field at the top of the Mokelumne River Formation is a northeast-southwest trending elliptical anticline (Figure F-13), with an original gas-water contact at approximately -4,783 feet subsea. The limits of the gas field were determined from well log correlations (as depicted on geologic cross-sections in Figures F-5, F-6 and F-7), from limited reservoir pressure data for wells inside and outside of the King Island field Mokelumne River Formation reservoir (Piacentine #1-27 and King Island #1-28; discussed below in Section G.5), and from a 3-D seismic survey amplitude anomaly related to the gas reservoir at the top of the Mokelumne River Formation section[1]. The high amplitude signature on the seismic data is the result of a strong acoustic impedance contrast between the relatively high impedance Capay Shale and the relatively low impedance gas-charged reservoir. The Mokelumne River Formation in the gas field is not complicated by faulting. The reservoir sand is truncated north of the fault that is mapped on the south side of the gas field, as discussed earlier in Section G.4. The above-described paleo-landslide feature is limited to overlying Eocene Capay and lower Domengine sediments above the reservoir. Neither of these structures are interpreted to affect the reservoir.

G.5 CONFINING ZONES

The competency of the confining zones that form the top and lateral seals for the King Island gas field is demonstrated by the fact the gas accumulation was trapped and held intact for several million years before gas production started.

The chief confining zone is the Eocene Capay Shale, which provides the overlying impermeable seal of the Mokelumne River Formation reservoir at King Island. The Capay is a regional mudstone and claystone unit that ranges in thickness from 90 to 120 feet in the vicinity of King Island. It is locally thinned to approximately 35 feet near the head scarp of the paleo-landslide discussed above (Figure F-10). The Capay provides the cap rock for many of the gas fields and pools in the southern Sacramento Valley (California Department of Oil and Gas, 1982). The competency of the seal, even at the thin area at the head of the paleo-landslide, is demonstrated by the fact that the gas accumulation has never been breached.

Static formation pressure measurements taken in March 2013 in the Piacentine #2-27 using Halliburton's Reservoir Description Tool (RDT™) demonstrate that the Capay Shale currently forms an effective pressure barrier (Attachment C-1; Table G-5). A sand at the base of the Domengine section

[1] PG&E and its contractors were allowed by the King Island gas field operator to view relevant portions of its confidential 3D seismic survey.

had a static pressure of 2,022 pounds per square inch (psi) and a normal pressure gradient of 0.437 psi/ft. Sands in the Mokelumne River Formation above the original gas/water contact had depleted pressures (due to gas production and subsequent pressure rebound) ranging from 1,909 to 1,949 psi, and a pressure gradient of 0.407 psi/ft. The RDT™ results indicate that the Capay shale is an effective pressure seal in the area, even where it is thinnest (at the Piacentine #2-27), and provide further confirmation of the overall sealing capacity of the Capay Shale.

Two approaches were used to determine the harmonic mean vertical permeability at confining stress of the Capay Shale. The first approach took the harmonic mean of three caprock/threshold pressure analyses providing vertical permeability at 2600 psi confining stress and one vertical permeability analysis at ambient stress (250 psi), corrected to 2700 psi confining stress based on the average ratio of ambient to stress permeability of 0.282 (Table G-1). The harmonic mean vertical permeability based on the first approach was 0.04 mD (Table G-6). The second approach took the harmonic mean of 17 horizontal ambient stress (250 psi) permeability measurements in the Capay Shale, corrected to 2700 psi confining stress as described above, and further corrected to vertical permeability using the average vertical to horizontal permeability anisotropy ratio of 0.80 (Table G-2). The harmonic mean vertical permeability based on the second approach was 0.06 mD (Table G-6). These two vertical permeability estimates are nearly the same and represent reasonable estimates of the vertical permeability of the Capay Shale at confining stress. The caprock / threshold pressure tests done on three Capay Shale core samples at net confining stress of 2600 psi showed no brine breakthrough up to the 2,000 psi maximum injection pressure.

Lateral sealing of the King Island reservoir is created by Capay Shale drape over the Mokelumne River erosional island, as well as by older Paleocene Meganos Channel shales that underlie the Capay Shale. These Meganos channel mudstones and claystones fill the large erosional channel that created the erosional trap ay King Island. Several small gas pools are trapped by these shales, including at King Island #1-28 located 750 feet to the northwest, East Islands Gas Field located about 1.25 miles to the north, and some others located a few miles to the south of King Island (May and others, 2007). The interpreted outline for the small gas pool in Meganos Channel fill sand in the King Island 1-28 is shown on the maps in Figures F-9, F-10 and F-11. The gas pool in the King Island 1-28 occurs in thin sand that lies directly below the Capay Shale, and is sealed at the top by the Capay Shale and laterally by shales of the Meganos Channel Fill. Figure F-6 shows that the King Island 1-28 gas sand occurs within the Meganos Channel fill and is separated stratigraphically from the King Island Mokelumne River Formation gas reservoir.

The King Island gas reservoir is truncated by shale of the Meganos Channel fill just to the north of the King Island #1-33 well (Figures F-12 and F-13). In the King Island #1-33, basal channel shale cuts into the top of the clay-silt-sand layer separating the King Island reservoir and the MR-2 (Figure F-12). Both the King Island #1-33 and the Piacentine #1 occur outside the southern limit of the King Island reservoir.

Shut-in tubing head pressure measurements taken in September 2005 in the King Island #1-28 and the Piacentine #1-27 wells, located ¾-mile apart, show that the Meganos Channel fill gas reservoir sand in

which the King Island #1-28 was perforated was at a different pressure than the Mokelumne River Formation gas reservoir sand in which the Piacentine #1-27 was perforated. These records are included in Attachment C-1. The King Island #1-28 well history showed a shut-in casing pressure of 1840 psi in September 2005, about 1 month after completion. The shut-in tubing pressure was reported as 1700 psig, but there was a fluid level in the tubing at 4500 feet. The weight of the water in the tubing reduced the surface pressure by about 118 psi (0.433 x [4772' - 4500']), which mostly accounts for the pressure difference between the shut-in tubing pressure and the shut-in casing pressure. An Excel utility program was used to translate the shut-in casing pressure to a bottom hole pressure of 2050 psig (2065 psia). This pressure translates to a hydrostatic gradient of 0.4327 psi/ft (2065 psi/4772 ft), which is a normal hydrostatic gradient. This analysis indicates that the sand lens in the Meganos Channel fill was at hydrostatic pressure in September 2005 when the bottom hole pressure in the King Island #1-27 was 1679 psi, approximately 343 psi below a normal hydrostatic pressure ([4670 ft * 0.433 psi/ft] - 1679 ft), and supports a conclusion that the Mokelumne River Formation reservoir was not hydraulically connected to the Meganos Channel fill sand. The equations and input parameters used to derive the bottomhole pressures for the Piacentine #1-27 and King Island #1-28 wells are provided in Attachment G-3.

Additional evidence that the Meganos Channel fill and the Mokelumne River Formation reservoir are not hydraulically connected is the timing of water influx in the Moresco et. Al Unit A-1 relative to when the King Island #1-28 well was drilled. The Moresco et. Al Unit A-1 well perforations (top at 4698 ft) in the Mokelumne River Formation reservoir were overrun by water in 1995 (Attachment G-4), ten years before the King Island #1-28 was drilled and perforated at 4772-4778 ft. If the two reservoirs were in communication, the Meganos Channel fill reservoir in the King Island #1-28 well should have been wet.

Thin (generally less than 50 feet) low permeability layers composed of interbedded mudstone, claystone, and thin, silty sandstones separate the Mokelumne River Formation sand packages (including the gas reservoir and underlying MR2 and MR3 aquifers described in Section G.4). Production histories discussed earlier in Section A.5 indicate that these zones are leaky confining layers that have allowed formation water in the Mokelumne River Formation sands underlying the gas reservoir to slowly recharge and re-pressure the reservoir during periods of production cessation or decline (Attachment C-1). The RDT™ pressure data in the Piacentine #2-27 show that the pressure gradient on either side of the clay-silt-sand layer that separates the Mokelumne River Formation reservoir from the underlying upper MR-2 sand package is nearly the same, and indicate that pressure attenuation across the layer is weak (Table G-5). This pressure sealing capacity of the deeper Mokelumne River Formation lower permeability layers is expected to be similar to the layer separating the reservoir from the upper MR-2 sands, based on their similar SP and gamma ray log signatures.

The base of the Mokelumne River Formation is characterized by a regional impermeable shale unit known as the H&T Shale. It separates the fluvial-deltaic Mokelumne River sands from the underlying Upper Cretaceous marine sandstones of the Starkey Formation.

Overlying the Domengine Formation is the Nortonville shale, which is approximately 100 feet thick in the vicinity of King Island. Though the Capay shale on its own is considered an excellent seal for the

Mokelumne River Formation reservoir, the Nortonville provides a competent shallower secondary seal, a redundant layer of protection to USDWs in the overlying Markley Formation and the Plio-Miocene formations.

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Table G-1
Average Ambient and Stress Porosity and Horizontal Permeability
Mokelumne River Formation Reservoir Sands

	Horizontal Permeability Averages (mD)	
Porosity Arithmetic Mean (%)	**Ambient (250 psi)**	**Stress (Corrected to 2,700 psi)**
30.6	2,862	807

Horizontal Permeability (mD) at Ambient Stress (250 psi)	**Horizontal Permeability (mD) at Confining Stress (2,700 psi)**	**Ratio: Stress to Ambient Permeability**
2,352	805	0.342
275	133	0.483
10	4	0.385
6,820	1,782	0.261
5,766	1,477	0.256
9,998	2,847	0.285
9,680	2,018	0.208
10,373	1,875	0.181
7,050	1,213	0.172
19,496	2,167	0.111
17,819	2,248	0.126
788	187	0.237
3,618	1,409	0.389
3,347	1,102	0.329
1,831	846	0.462
Average Permeability Ratio:		**0.282**

Table G-1

Piacentine #2-27

Mokelumne River Formation Reservoir Sands

Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)	Outlier Porosity Points (%)	Outlier Permeability Points (mD)
4641.5	35.4	6194.2		
4642.6	34.1	12931.7		
4643.5	33.8	1375.5		
4644.5	35.5	3272.1		
4645.5	32.5	312.6		
4646.5	33.5	779.1		
4647.5	33.8	1119.3		
4648.5	33.0	2104.8		
4649.5	34.9	809.7		
4650.5	33.0	1462.9		
4651.5	33.7	962.5		
4652.5	31.9	456.3		
4653.5			4.8	0.1
4654.5	31.6	498.8		
4655.5	28.9	55.9		
4656.5	30.7	385.7		
4657.5	30.3	68.6		
4658.5	28.7	771.2		
4659.5	28.7	380.9		
4660.5	29.1	246.2		
4661.5	28.9	622.1		
4662.5	30.4	50.6		
4666.5	24.6	40.2		
4667.5	26.1	0.45		
4668.5	31.1	158.0		
4669.5	29.1	158.4		
4670.5	30.4	53.4		
4671.5	30.1	278.3		
4672.5	28.2	0.98		
4673.5	31.0	114.3		
4674.5	29.4	0.19		
4675.5	28.1	0.051		
4676.5	27.3	0.45		
4677.5	27.4	0.13		
4678.5	27.1	0.66		

Table G-1

Piacentine #2-27

Mokelumne River Formation Reservoir Sands

Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)	Outlier Porosity Points (%)	Outlier Permeability Points (mD)
4679.5	26.9	0.21		
4680.5			13.9	0.1
4681.5	24.5	3.0		
4682.5	26.7	1.1		
4683.3	27.2	9.9		
4684.5	25.6	202.6		
4687.6	25.4	4.8		
4688.5	24.1	1.4		
4689.5	28.3	14.6		
4690.5	23.9	2.8		
4691.5	22.8	73.6		
4692.5	27.2	2.4		
4693.5	25.7	6.8		
4694.5	25.1	3.4		
4695.5	38.5	767.8		
4696.5	32.2	152.5		
4697.8	26.0	38.0		
4698.5	32.9	58.9		
4699.5	31.0	79.1		
4701.5	24.4	0.42		
4702.5	22.1	0.11		
4703.5	27.5	28.4		
4704.5	34.2	225.1		
4705.5	24.8	0.049		
4706.5	22.7	0.57		
4707.5	23.6	0.26		
4708.5	22.8	0.028		
4709.5	22.6	0.44		
4710.5	23.1	0.70		
4711.5	24.3	0.95		
4712.5	27.7	7.7		
4713.5	24.0	0.014		
4714.5	23.8	1.5		
4715.5	24.8	1.3		
4716.5	24.0	3.8		

Table G-1
Piacentine #2-27
Mokelumne River Formation Reservoir Sands
Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)	Outlier Porosity Points (%)	Outlier Permeability Points (mD)
4717.5			1.6	0.0
4718.5	29.9	17.0		
4719.5	30.6	35.7		
4720.5	32.5	122.1		
4721.5	33.6	169.8		
4722.5	36.0	845.7		
4723.5	34.1	854.7		
4724.5	33.1	476.3		
4725.5	32.0	465.1		
4726.3	33.9	250.6		
4727.5	25.4	30.2		
4728.5	22.3	0.014		
4729.5	23.3	0.11		
4730.5	23.1	0.028		
4731.5	30.0	68.2		
4732.5	26.8	2.1		
4733.5	31.9	23.0		
4734.5	31.7	16.3		
4735.5	28.2	0.81		
4736.5	25.9	2.3		
4737.5	28.1	13.1		
4738.5	23.7	0.052		
4739.5	26.5	135.7		
4740.5	24.8	10.2		
4741.5	24.0	70.9		
4742.5	23.9	4.8		
4743.5	26.9	8.1		
4744.5	33.6	238.0		
4745.5	28.3	3.0		
4746.5	27.2	1.9		
4747.5	26.2	1.4		
4748.5	27.7	192.9		
4749.5	31.0	29.6		
4750.5	26.0	33.4		
4751.5	26.5	0.40		
4752.5	26.3	4.1		

Table G-1

Piacentine #2-27

Mokelumne River Formation Reservoir Sands

Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)	Outlier Porosity Points (%)	Outlier Permeability Points (mD)
4753.5	26.3	1.5		
4754.5	26.3	0.77		
4755.5	32.7	1475.7		
4756.5	34.5	3063.5		
4757.5	34.9	3709.7		
4758.5	35.7	5333.6		
4759.5	35.4	6521.5		
4760.5	38.1	7758.9		
4761.5	35.5	19736.7		
4762.5	34.0	4926.5		
4763.5	33.9	4345.4		
4764.5	35.7	4604.9		
4765.5	35.4	4760.9		
4766.5	35.9	13229.0		
4767.5	35.1	12954.9		
4768.5	33.6	3183.2		
4769.5	30.2	3407.1		
4770.5	36.3	13197.8		
4771.5	34.8	18985.0		
4772.5	36.3	13691.1		
4773.5	34.6	17328.8		
4774.7	36.8	22855.6		
4775.5	35.6	19087.1		
4776.8	35.6	19236.8		
4777.5	33.9	19236.3		
4778.5	33.6	5514.1		
4779.5	34.1	3451.7		
4780.5	34.3	3745.0		
4781.5	34.8	4148.9		
4782.5	32.0	1074.8		
4783.5	31.8	602.5		
4784.5	33.1	3749.0		
4785.5	31.5	863.6		
4786.5	34.7	3359.4		
4787.5	35.6	1577.2		
4788.5	35.7	1133.6		

Table G-1
Piacentine #2-27
Mokelumne River Formation Reservoir Sands
Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)	Outlier Porosity Points (%)	Outlier Permeability Points (mD)
4790.2	36.0	2907.3		
4791.2	34.3	5283.8		
4792.2			44.1	14376.7
4793.2	33.6	6898.2		
4794.2	34.6	4047.7		
4795.2	33.6	4631.9		
4796.2			55.3	12667.0
4797.2	37.1	20634.2		
4798.2	32.7	1043.8		
4799.2	34.0	1864.4		
4800.2	35.5	3528.3		
4801.2	36.7	5937.6		
4802.5	36.9	6487.3		
4803.5	36.2	4380.4		
4804.5	36.6	5655.0		
4805.5	36.7	11882.6		
4806.5	35.8	4233.0		
4807.5	34.5	2929.5		
4808.5	36.3	11376.2		
4809.5	36.1	8176.6		
4810.5	35.0	5534.8		
4811.5	35.5	8459.1		
4812.5	33.7	13347.1		
4813.5	35.5	5718.5		
4814.5	36.7	8055.9		
4815.5	25.5	186.6		

Table G-2
Vertical-Horizontal Permeability Anisotrophy Ratio
Mokelumne River Formation Reservoir Sands

Horizontal Permeability (mD) [1]	Vertical Permeability (mD) [2]	Ratio: Vertical to Horizontal Permeability
0.45	0.044	0.098
152.5	277.7	1.821
3709.7	2383.4	0.642
12954.9	8096.7	0.625
13197.8	11285.7	0.855
19087.1	17855.2	0.935
3451.7	2544.7	0.737
1074.8	1816.9	1.690
602.5	505.8	0.840
5283.8	6025.2	1.140
4047.7	1541.5	0.381
6487.3	1147.7	0.177
4233.0	3855.1	0.911
11376.2	5293.1	0.465
5534.8	3404.4	0.615
Average Permeability Ratio:		**0.796**

Notes

(1) Horizontal permeability at 250 psi confining stress at same, or nearly same, depth as vertical permeability measurement.

(2) Vertical permeability at 250 psi confining stress.

Table G-3
Vertical Permeability
Mokelumne River Formation Clay-Silt-Sand Layers

Depth (feet)	Lithology	Vertical Permeability (mD) at Confining Stress	Harmonic Mean Permeability (mD)
4,676	Capay shale [1]	0.4	1.29
4,696.5	Thin MRF sand/silt in upper MRF reservoir unit [2]	78.3	
4,783.6	Shaly-silty sand in lower MRF reservoir unit [2]	142.6	

		Harmonic Mean Permeability (mD)		
Depth (feet)	Lithology	Horizontal Permeability at Ambient Stress (250 psi)	Horizontal Permeability Corrected to Confining Stress (2700 psi)	Corrected to Vertical Permeability [3]
4661.5 to 4754.5	Capay Shale to 4680' underlain by thinly-bedded and interlayered clays, silts and sands in upper MRF reservoir unit	0.25	0.07	0.06

Notes

(1) From caprock analysis at 2600 psi confining stress (Attachment G-2)

(2) From vertical permeability analysis at 250 psi confining stress; corrected to 2700 psi stress based on average stress to ambient permeability ratio (see Table G-1).

(3) Based on vertical to horizontal permeability anisotrophy ratio (see Table G-2)

MRF = Mokelumne River Formation

Table G-3 Data Table

Piacentine #2-27

Capay Shale and Upper Mokelumne River Formation Reservoir Sands

Average Permeability for sand-silt-clay sequence

Depth	Porosity (%)	Permeability (mD)
4661.5	28.9	622.1
4662.5	30.4	50.6
4666.5	24.6	40.2
4667.5	26.1	0.45
4668.5	31.1	158.0
4669.5	29.1	158.4
4670.5	30.4	53.4
4671.5	30.1	278.3
4672.5	28.2	0.98
4673.5	31.0	114.3
4674.5	29.4	0.19
4675.5	28.1	0.051
4676.5	27.3	0.45
4677.5	27.4	0.13
4678.5	27.1	0.66
4679.5	26.9	0.21
4680.5		
4681.5	24.5	3.0
4682.5	26.7	1.1
4683.3	27.2	9.9
4684.5	25.6	202.6
4687.6	25.4	4.8
4688.5	24.1	1.4
4689.5	28.3	14.6
4690.5	23.9	2.8
4691.5	22.8	73.6
4692.5	27.2	2.4
4693.5	25.7	6.8
4694.5	25.1	3.4
4695.5	38.5	767.8
4696.5	32.2	152.5
4697.8	26.0	38.0
4698.5	32.9	58.9
4699.5	31.0	79.1
4701.5	24.4	0.42
4702.5	22.1	0.11
4703.5	27.5	28.4

Table G-3 Data Table

Piacentine #2-27

Capay Shale and Upper Mokelumne River Formation Reservoir Sands

Average Permeability for sand-silt-clay sequence

Depth	Porosity (%)	Permeability (mD)
4704.5	34.2	225.1
4705.5	24.8	0.049
4706.5	22.7	0.57
4707.5	23.6	0.26
4708.5	22.8	0.028
4709.5	22.6	0.44
4710.5	23.1	0.70
4711.5	24.3	0.95
4712.5	27.7	7.7
4713.5	24.0	0.014
4714.5	23.8	1.5
4715.5	24.8	1.3
4716.5	24.0	3.8
4717.5		
4718.5	29.9	17.0
4719.5	30.6	35.7
4720.5	32.5	122.1
4721.5	33.6	169.8
4722.5	36.0	845.7
4723.5	34.1	854.7
4724.5	33.1	476.3
4725.5	32.0	465.1
4726.3	33.9	250.6
4727.5	25.4	30.2
4728.5	22.3	0.014
4729.5	23.3	0.11
4730.5	23.1	0.028
4731.5	30.0	68.2
4732.5	26.8	2.1
4733.5	31.9	23.0
4734.5	31.7	16.3
4735.5	28.2	0.81
4736.5	25.9	2.3
4737.5	28.1	13.1
4738.5	23.7	0.052
4739.5	26.5	135.7
4740.5	24.8	10.2
4741.5	24.0	70.9

Table G-3 Data Table

Piacentine #2-27

Capay Shale and Upper Mokelumne River Formation Reservoir Sands

Average Permeability for sand-silt-clay sequence

Depth	Porosity (%)	Permeability (mD)
4742.5	23.9	4.8
4743.5	26.9	8.1
4744.5	33.6	238.0
4745.5	28.3	3.0
4746.5	27.2	1.9
4747.5	26.2	1.4
4748.5	27.7	192.9
4749.5	31.0	29.6
4750.5	26.0	33.4
4751.5	26.5	0.40
4752.5	26.3	4.1
4753.5	26.3	1.5
4754.5	26.3	0.77

Table G-4
Effective Porosity and Permeability, Mokelumne River Formation Sands

Mokelumne River Formation Sand Intervals (Approx. Vertical Depth Interval in Citizen-Green #1)	Porosity (%)	net sand (ft)	Weighted avg. Porosity (%)	Ambient Permeability [(1)] (mD)	Stress Permeability [(2)] (mD)	Weighted avg. Ambient Permeability (mD)	Weighted avg. Stress Permeability (mD)
Upper MR-2 (5010'-5085')	15	5	29.1	0.001	0.0003	364	103
	28	17		17	5		
	33	23		700	197		
Total net sand		**45**					
Lower MR2 (5120'-5360')	33	90	32.7	700	197	2243	632
	36	46		7000	1974		
	33	17		700	197		
	25	24		1.7	0.5		
Total net sand		**177**					
MR-3 (5397'-5666')	29	32	28.4	32	9	34	10
	30	8		75	21		
	29	35		32	9		
	30	31		75	21		
	28	31		17	5		
	25	27		1.7	0.5		
Total net sand		**164**					
MR-4 (5692'-6005')	27	22	29.7	7	2	69	19
	30	9		75	21		
	30	29		75	21		
	30	22		75	21		
	30	20		75	21		
	30	95		75	21		
	30	40		75	21		
Total net sand		**237**					

Notes

Permeabilities based on porosities from Citizen-Green #1 neutron-density logs and cross-plot of core porosity and permeability from Mokelumne River Fm reservoir sand in Piacentine 2-27 (see Graph G-1).

(1) Permeability at 250 psi confining pressure

(2) Permeability at 2700 psi confing pressure, based on average K (2700 psi) to K (250 psi) ratio of 0.282 (see Table G-1)

Table G-5
Depth Discrete Pressure Data
Piacentine 2-27 RDT Log

Formation Zone	Depth	Original Pressure (psi)[1]	Est. Lowest Pressure (psi)[2]	Pressure Test Data (psi) [3]	Pressure Gradient at time of RDT (psi/ft) [3, 4]	Pressure Deviation from Hydrostatic Gradient (psi)
Domengine Sand	4630	--	--	2021.65	0.4366	16.9
Upper Mokelumne Reservoir	4695	2080	1000	1908.98	0.4066	-124.0
	4720			1920.06	0.4068	-123.7
	4754			1934.5	0.4069	-124.0
	4762			1937.94	0.4070	-124.0
	4774			1943.78	0.4072	-123.4
	4774			1943.08	0.4070	-124.1
	4788			1949.21	0.4071	-124.0
	4793			1951.75	0.4072	-123.6
	4804			1956.14	0.4072	-124.0
	4810			1958.78	0.4072	-124.0
MR2 Sand (Below Sub Reservoir Shale)	4880	--	--	1989.77	0.4077	-123.3
	4890			1994.05	0.4078	-123.3

Notes:

(1) Discovery pressure in Moresco et al. Unit A 1. See Attachment C-1.

(2) Interpreted from tubing head measurements during production. See Attachment A-1.

(3) Pressure measurements taken using Halliburton Reservoir Description Tool (RDT™) on March 25, 2013. See Attachment G-1 for complete report.

(4) Hydrostatic gradient is calculated as 0.433 psi/ft assuming the density of fresh water. Actual gradient in saline formations will be slightly higher.

psi = pounds per square inch

Table G-6
Vertical Permeability of Capay Shale

Depth (feet)	Vertical Permeability (mD) at Ambient Stress (250 psi)	Vertical Permeability (mD) corrected to Confining Stress (2700 psi)[2]	Vertical Permeability (mD) at Confining Stress (2600 psi)[1]	Harmonic Mean Permeability (mD)
4,657.0			7.18	0.04
4,667.0			0.08	
4,676.0			0.43	
4,676.0	0.04	0.01		

	Harmonic Mean Permeability (mD)		
Depth (feet)	Horizontal Permeability at Ambient Stress (250 psi)	Horizontal Permeability Corrected to Confining Stress (2700 psi)[2]	Corrected to Vertical Permeability [3]
4661.5 to 4680.5	0.27	0.07	0.06

Notes

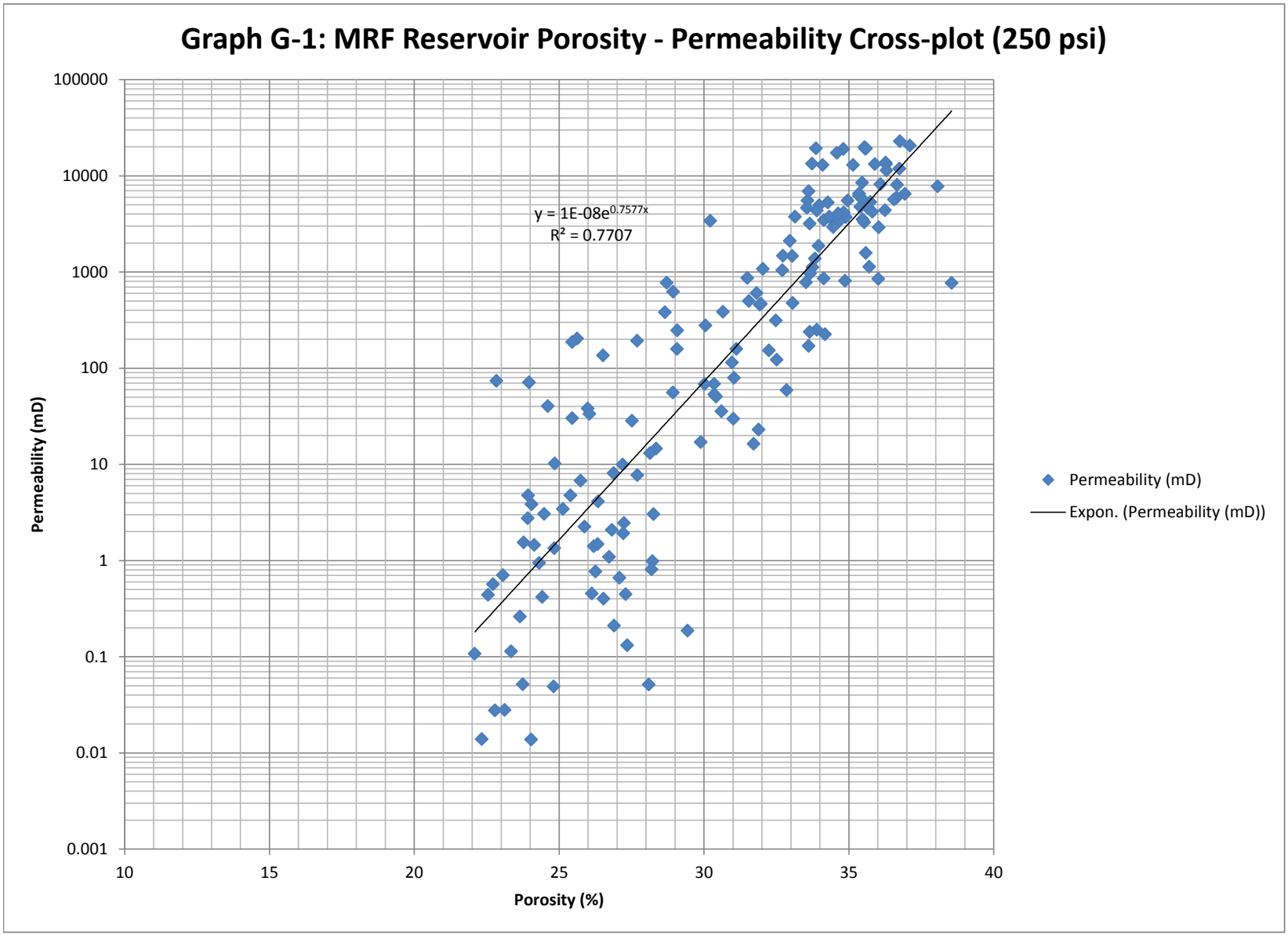
(1) From caprock analysis at confing stress (complete report in Attachment G-2)

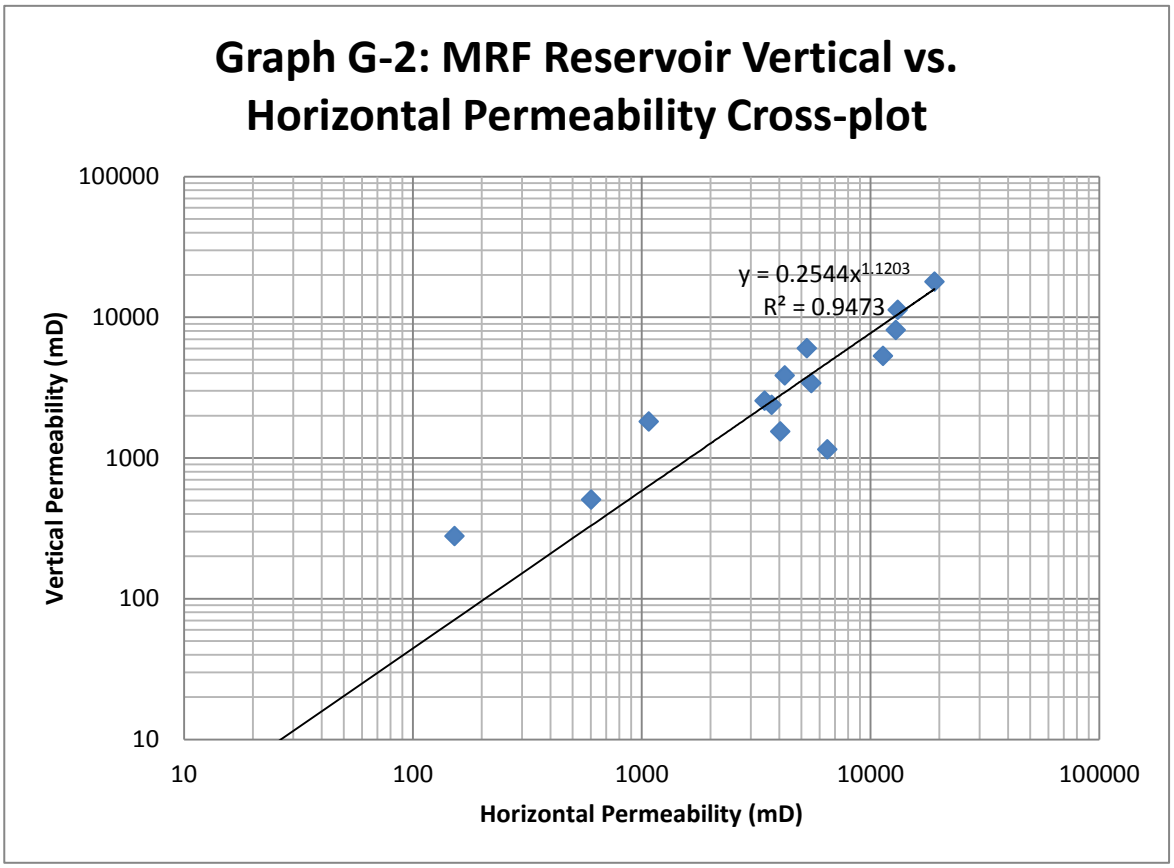
(2) Based on average stress to ambient permeability ratio (see Table G-1)

(3) Based on vertical to horizontal permeability anisotrophy ratio (see Table G-2)

Table G-6 Data Table
Piacentine #2-27
Capay Shale
Horizontal Permeability

Depth	Porosity (%)	Permeability (mD)	Vertical Perm (mD)
4661.5	28.9	622.1	
4662.5	30.4	50.6	
4666.5	24.6	40.2	
4667.5	26.1	0.45	0.08
4668.5	31.1	158.0	
4669.5	29.1	158.4	
4670.5	30.4	53.4	
4671.5	30.1	278.3	
4672.5	28.2	0.98	
4673.5	31.0	114.3	
4674.5	29.4	0.19	
4675.5	28.1	0.051	
4676.5	27.3	0.45	0.43
4677.5	27.4	0.13	
4678.5	27.1	0.66	
4679.5	26.9	0.21	
4680.5	13.9	0.1	


Graph G-1: MRF Reservoir Porosity - Permeability Cross-plot (250 psi)
y = 1E-08e^0.7577x
R² = 0.7707
Permeability (mD)
Porosity (%)
100000
10000
1000
100
10
1
0.1
0.01
0.001
10
15
20
25
30
35
40
Permeability (mD)
Expon. (Permeability (mD))


Graph G-2: MRF Reservoir Vertical vs. Horizontal Permeability Cross-plot
y = 0.2544x^1.1203
R² = 0.9473
Vertical Permeability (mD)
Horizontal Permeability (mD)
100000
10000
1000
100
10
10
100
1000
10000
100000

ATTACHMENT G-1 – PIACENTINE 2-27 CORE ANALYSIS REPORTS

REPORT DESCRIPTION	DATE RECEIVED
Core Description	4/16/2013
Sidewall Core Analysis Results	4/9/2013
Vertical Permeability Analysis	5/8/2013
Humidity Controlled Core Analysis Results	4/28/2013
Core Analysis Procedures and Conditions (Conventional Core)	4/28/2013
Core Analysis Procedures and Conditions (Sidewall Core)	4/9/2013
Conventional Core Analysis Results	4/28/2013
Core Spectral Gamma	Not Indicated
Total Gamma API	Not Indicated
CMS Core Analysis	6/19/2012
Petrologic Analysis of Conventional Core Samples	6/21/2013
Special Core Analysis Study – Capillary Pressure Final Report	8/29/2013
Special Core Analysis Study – Caprock Analysis Final Report	7/3/2013
Special Core Analysis Study – Critical Velocity Report	11/25/2013
Special Core Analysis Study – High Pressure Mercury Injection Report	8/19/2013
Special Core Analysis Study - Triaxial Report	9/23/2013
Special Core Analysis Study – Thick Wall Cylinder Report	8/16/2013
Geochemical Analysis	4/29/2013

CORE DESCRIPTION

PG&E Piacentine #2-27
King Island Gas Field
San Joaquin Co., California
Sec. 27, T3N-R5E

Described by F. Cressy, 4/16/2013

Coring commenced at 4641 feet and finished at 4816 feet; a gross interval total of 175 feet cored during seven core runs. Coring began in the Eocene lower Domengine sand, continued through the entire Eocene Capay shale (unit faulted), and penetrated 129 feet of the top Upper Cretaceous Mokelumne River Formation. A general description of the formations follows.

GENERAL DESCRIPTION

Domengine Sand: 4641' to 4653.5' (12.5 feet lower Domengine)

Predominately sand, light gray, contains thin to thick beds of sand, some fine grained, others medium to coarse grained, minor conglomerate, beds massive to very thinly laminated & cross laminated; arkosic, fair to well sorted, easily friable, excellent porosity and permeability; basal 10 inches is hard, calcareous cemented sandstone. Sharp, conformable(?) contact with underlying Capay shale.

Capay Shale: 4653.5' to 4687.1' (33.6'; approx. 75 feet faulted-out)

Predominately claystone; dark greenish gray to dark gray on a fresh surface, waxy luster, appears massive, compact to firm, slightly calcareous w/ common scattered large (to 1") pyrite nodules and occasional small, thin shelled mollusk fragments. This claystone appears to contain swelling clays. As it dries, it begins to crack and break into small pieces.

Fault between 4661.8 and 4666'

Top one foot is highly sheared claystone; nearly all fragments have shiny, slickensided surfaces; no recovery in bottom 3 feet.

Claystone below fault is greenish gray (lighter than above), with papery thin laminations; fossils are non-existent or extremely rare. Gradual color change with depth to olive gray and then dark olive gray; fossils increase in abundance; glauconite increases from ~5% at

4673.8' to about 30% at 4681'. As glauconite increases, the claystone also exhibits an increasingly mottled appearance due to burrowing organisms.

At 4682', unit becomes conglomeratic, greenish black color, abundant glauconite, hard due to calcareous cement, rounded clasts to 1' diameter (at wellsite, two cobbles of 2" diameter were noted). Clasts appear to be mostly chert, volcanic, and quartz. Conglomerate extends to 4687.1', but there was no recovery of bottom 2.5 feet; abrupt, unconformable contact with underlying Mokelumne River Fm.

Mokelumne River Formation: 4687.1' through bottom of cored interval at 4816'

Upper unit: 4687.1' to 4755' (67.9 feet)

Predominately claystone and siltstone; medium gray, paper-thin laminations to mottled, firm, non calcareous; common occurrence carbonaceous material, at times highly carbonaceous. Minor thin sands, generally very fine to fine grained, silty, clayey.

Sand at 4695' to 4700': fine grained, trace medium grained, silty, biotitic, small scale cross laminations; good porosity and permeability.

Sand at 4716.9' to 4727': medium gray, very fine grained (top one foot, hard, calcareous cement); below this very fine to fine grained, silty, thinly laminated with carbonaceous material(?) and mica, sometimes mottled, minor shale rip ups, minor small scale cross laminations. Good porosity & permeability.

Lower unit: 4755.8' to 4816' (60.2 feet)

Predominantly sand; light gray, medium grained, arkosic, common large scale cross-laminations defined by black biotite and carbonaceous(?) material; easily friable, excellent porosity and permeability, no cement; at times, massive with a mottled appearance, minor mud clasts (rip ups) and coaly wood fragments; one-foot-thick lignite coal bed at 4795.9'. At bottom of core (4815.4) brownish-gray shale, fissile w/ paper-thin laminations.

At 4784.7', a large (6') calcareous concretion observed, very hard, calcareous cement. Corresponds to depth where logs indicate original g/w contact. Other than this, there was no difference noted in sands above and below the original g/w contact.

DETAILED DESCRIPTION

DEPTH	THICKNESS	DESCRIPTION
Domengine Sand		
4641’ to 4643’	2.0’	Sand: light gray, pred. medium & coarse grained, fair -well sorted, easily friable, arkosic, faint cross laminations to massive, bedding poorly defined, but appears 2” to 3” wide, no cement, excellent porosity & permeability; gradational to:
4643’ to 4643.2	0.2’	Conglomerate: light med gray, clasts to 1” dia, pred quartz and dark gray chert, rounded clasts in matrix of med to coarse sand; gradational to:
4643.2’ to 4645’	1.8’	Sand: light to med gray, pred fine to med grained, arkosic; somewhat well defined, thin low-angle cross laminations caused by carbonaceous**(?)** material or biotite.
4645’ to 4645.5’	0.5’	Sand: med gray, fine grained, thinly interbedded w/ clayey, slty, very fine grained sand, ~0.5” beds; small normal fault, dips 60°, 0.5” displacement; gradational to:
4645.5’ to 4652.7’	7.2’	Sand: light gray, fine to med grained, easily friable, faint very thin (1-2mm) horizontal to low-angle, biotite-rich cross laminations; sharp, horizontal contact overlying:
4652.7’ to 4653.5	0.8’	Sandstone: light med gray, very fine to fine grained, hard, calcareous cement, very thinly laminated. Contact very sharp, erosional?
Capay Shale		
4653.5’ to 4661.8’	8.3’	Claystone: dk greenish gray, dk gray on a fresh surface, firm to compact, massive, calcareous, common large scattered pyrite nodules to 15mm diameter, abundant small pyrite <1mm, occasional

		small fossil mollusk frags; low angle (25° to 30°) fractures near base.
4661.8’ to 4662.9’	1.1’	**Fault breccia**: highly sheared and broken Capay shale; abundant slickensides, curved with shiny luster.
4662.9’ to 4666’	3.1’	No Recovery
4666’ to 4673.2’	7.2’	Claystone: greenish gray (slightly lighter color than above), firm to compact, paper-thin to very thinly laminated, sl. calcareous, fossils very rare to not present; gradational change to:
4673.2’ to 4682’	8.8’	Claystone: med light gray, then gradational to olive gray at base; loss of laminations, begins exhibiting a burrow-mottled appearance, increasing calcareous cement, increasing fossil mollusk frags, increasing small (0.5mm), rounded glauconite pellets; glauconite increases from ~5% at top to ~30% at base; gradational at base to:
4682’ to 4684.5’	2.5’	Conglomerate: greenish black color, abundant glauconite, hard due to calcareous cement, rounded clasts to 1’ diameter (at wellsite, two cobbles of 2” dia. were noted). Clasts appear to be mostly chert, volcanic, and quartz; appears tight.
4684.5’ to 4687’	2.5’	No Recovery
4687’ to 4687.1’	0.1’	Conglomerate: as above
Mokelumne River Formation		Unconformity; sharp contact
4687.1’ to 4690’	2.9’	Thinly interbedded mudstone, siltstone, and very fine grained sandstone; med gray, sands appears to have fair porosity & permeability; sand is thinly (1-3cm) bedded, silty mudstone in beds 2-4mm thick. Mudstone is sandy (very fine grained), poorly sorted; gradational into:

4690’ to 4692’	2.0’	Mudstone: med gray, silty, firm, massive, non-calcareous; gradational into:
4692’ to 4695’	3.0’	Sand: med gray, very fine grained, silty, friable, massive; gradational into:
4695’ to 4698.4’	3.4’	Sand: light med gray, pred fine grained, but ranges from silt to med grained, arkosic, small scale, very thin, multi-directional cross laminations in 2-4cm beds; fair to good porosity & permeability.
4698.4’ to 4700’	1.6’	Broken up sand, from core catcher, not in-situ. Med gray, very fine grained, silty, clayey, very thinly laminated, firm.
4700’ to 4701’	1.0’	No Recovery
4701’ to 4713.2’	12.2’	Mudstone: med dark gray, slightly burrow mottled, coaly plant debris (1 to 4mm) lying parallel to bedding, minor very fine grained silty sand, grading down to med gray claystone, firm, paper-thin laminations; abrupt, sharp contact with:
4713.2’ to 4713.4’	0.2’	Mudstone: med dark gray, firm, compact, mottled appearance, carbonaceous; gradational into:
4713.4’ to 4716.9’	3.5’	Mudstone: med gray, firm to compact, common small organic fragments in top foot of unit, commonly mottled; gradational into:
4716.9’ to 4717.9’	1.0’	Sandstone: med gray, very fine grained, hard, calcareous cement, tight; sharp contact overlying:
4717.9’ to 4720.5’	2.6’	Sand: med gray, very fine grained , silty, clayey, firm to friable, faint convoluted laminations to mottled; gradational into:
4720.5’ to 4721’	0.5’	Interbedded mudstone, med dark gray and med gray, very fine grained sand, very thinly laminated w/ carbonaceous material; sharp contact with:
4721’ to 4727’	6.0’	Sand: as above, fine grained w/ abundant

		carbonaceous material, mottled; gradational into:
4727’ to 4730.9’	3.9’	Claystone: light gray, paper-thin laminations, common flakes of carbonaceous and coaly material, clayey, very firm, exhibits irregular horizontal partings; sharp contact as parting.
4730.9’ to 4734’	3.1’	Sand: med light gray, very fine grained, clayey, faintly thinly laminated, firm to friable; gradational into:
4734’ to 4744.5’	10.5’	Silty claystone: med dark gray, faintly mottled to very thinly laminated, firm, compact, common small flakes of carbonaceous material; gradational into:
4744.5’ to 4745.7	1.2’	Sand: med light gray, very fine to fine grained, firm, paper-thin laminations, micaceous, grades down to dark gray carbonaceous mudstone, faintly mottled; irregular contact with:
4745.7’ to 4748.5’	2.8’	Mudstone: med dark gray, firm, compact, occasional very thin silty laminae; grades down to gray black carbonaceous shale, very thin papery laminations w/ irregular horizontal veinlets of lignitic coal to 2mm thick; sharp contact with:
4748.5’ to 4749.2’	0.7’	Mudstone: med dark gray, faint very thin laminations, minor small flakes of carbonaceous material; gradational contact with:
4749.2’ to 4750.7’	1.5’	Sand: med light gray, very fine to fine grained, papery thin laminations & small scale cross laminations; light gray sand laminated w/ dark gray biotite and/or carbonaceous material, upper portion of unit has fine cross laminations, lower portion is shaley w/ parallel laminations; sharp contact with:
4750.7’ to 4755.2’	4.5’	Mudstone & siltstone: dark gray to med dark gray, thin bedded (1-3cm), firm, occasional very fine grained sand; gradational contact with:

4755.2’ to 4755.8’	0.6’	Sand: light to med light gray, very fine to med grained, firm to friable, very thinly laminated, parallel to low angle cross laminations interbedded w/ silty & carbonaceous laminae; sharp contact with:
MAJOR LITHOLOGY CHANGE		
4755.8’ to 4759.9’	4.1’	Sand: light to med light gray, very fine to med grained, well sorted, paper-thin large scale cross laminations, common fine black carbonaceous material, easily friable, excellent porosity& permeability.
4759.9’ to 4765.1’	5.2’	Sand: loose, not in-situ; repacked in core liner at wellsite; light gray, predominately medium grained, arkosic, micaceous, one large fragment was thinly laminated.
4765.1’ to 4778’	12.9’	Sand: light gray, predominately med grained, easily friable, no cement, arkosic, commonly w/ large scale cross laminations, biotite & carbonaceous(?) laminations, single marble-sized calcareous concretion @ 4768.6’; gradational to:
4778’ to 4779.3’	1.3’	Sand: light gray, as above, two large, horizontal-lying, u-shaped lignitic beds that look as if partially ripped up and overturned, associated w/ common small mudstone or shale rip ups to 0.5 to 1.0 cm; gradational into:
4779.3’ to 4786.9’	7.6’	Sand: light gray, med grained, easily friable, thinly laminated, large scale 0.5 to 1.0mm cross laminations in 0.2’ to 1.5’ thick beds; large, hard calcareous concretion from 4784.7’ to 4785.4’.
4786.9’ to 4789.1’	2.2’	Sand: loose, not in-situ; repacked in core liner at wellsite; light gray, predominately medium grained, arkosic, micaceous.
4789.1’ to 4789.7’	0.6’	No Recovery

4789.7’ to 4795.9’	6.2’	Sand: light gray, pred med grained, well sorted, easily friable, large scale, low angle thin cross laminations, lignitic woody fragment from 4792.2’ to 4792.3’; sharp, irregular contact, erosional scour(?) at base.
4795.9’ to 4797.1’	1.2’	Lignite coal: dark gray to grayish black, massive, hackly fracture, tough; sharply overlies:
4797.1’ to 4798.3’	1.2’	Sand: light gray, med grained, appears massive w/ 2 vertical, sub-parallel carbonaceous “veins” extending below coal, possibly large root cast(?). Lower part of sand is fine grained, faint high angle (45°), very thin cross laminations; sharp contact with:
4798.3’ to 4801.2’	2.9’	Sand: light to med light gray, pred fine grained, large scale cross laminations at top grading down to chaotic, convoluted carbonaceous sand at base; coaly, lignitic material at base of unit, dark gray to grayish black; scoured erosional contact with:
4801.2’ to 4813.2’	12.0’	Sand: light gray, med grained, easily friable, well sorted, prominent low to high angle, large scale thin cross laminations in 0.4’ to 1.0’thick beds, excellent porosity & permeability.
4813.2’ to ~4815-	1.8’	Sand: loose, not in-situ; repacked in core liner at wellsite; light gray, predominately medium grained, arkosic, micaceous.
~4815’ to 4816’	1.0’	Shale & mudstone: dark gray, carbonaceous, very firm, tough, overlies silty mudstone, brownish gray, paper thin laminations, somewhat fissile, occasional very fine grained, thin sand. Note that large angular fragment of carbonaceous shale at top of unit is not in-situ, but is in its approximate stratigraphic position.

Core Depth and Recovery Summary

Core 1	4641’ to 4666’	Cut 25’, Recovered 22.8’	
Core 2	4666’ to 4687’	Cut 21’, Recovered 18.5’	
Core 3	4687’ to 4701’	Cut 14’, Recovered 13.85’	
Core 4	4701’ to 4731’	Cut 30’, Recovered 28.2’	
Core 5	4731’ to 4761’	Cut 30’, Recovered 32.0’	includes base of core 4
Core 6	4761’ to 4791’	Cut 30’, Recovered 28.2’	
Core 7	4791’ to 4816’	Cut 25’, Recovered 27.4’	includes base of core 6

Company: Pacific Gas and Electric Co.
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Field: King Island

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Drlg Fluid: LSND

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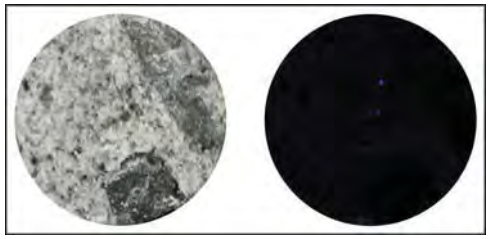
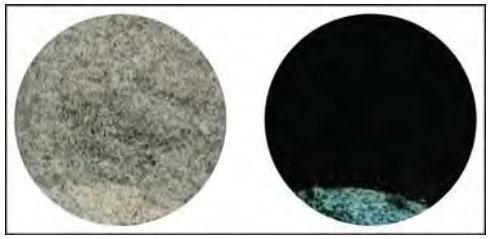
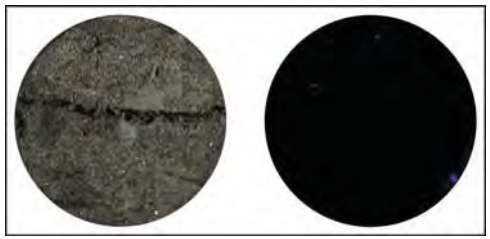
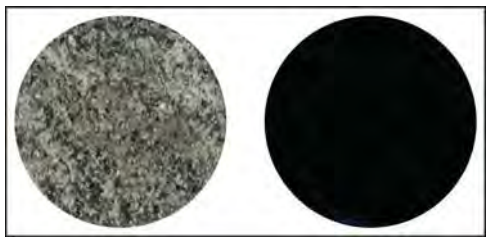
API No.: 04-077-20736
Date: 4/9/2013

Sidewall Core Analysis Results

Core Images White Light | UV Light	Sample Number	Depth ft	Rec in	Perm. Kair md	Porosity %	Fluid Saturation Oil %	Water %	O/W Ratio	Total %	Grain Den g/cc	Sample Wt. g	Method
	1	4640.0	0.2	200.0	25.0	0.0	59.5	0.00	59.5		3.6	3
	Sd gy vf-cgr slty sh incl no stn no flor											
	2	4696.0	0.5	38.5	31.2	0.5	89.2	0.01	89.7	2.65	13.9	1
	Sd gy-ltn vf-fgr vslty mica lstrk stn lblu-yel flor											
	3	4719.0	0.6	20.5	32.4	0.0	92.2	0.00	92.2	2.60	14.6	1
	Sd gy vfgr vslty carb strk cly incl mica no stn no flor											
	4	4753.0	0.7	195.5	32.5	0.0	89.0	0.00	89.0	2.69	19.0	1
	Sd gy vf-mgr slty mica no stn no flor											

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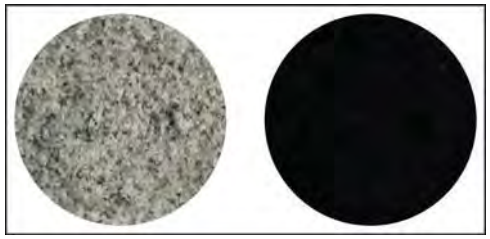
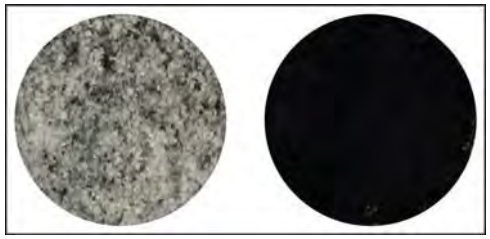
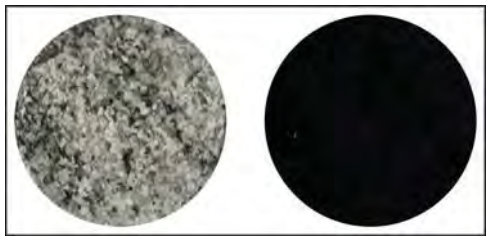
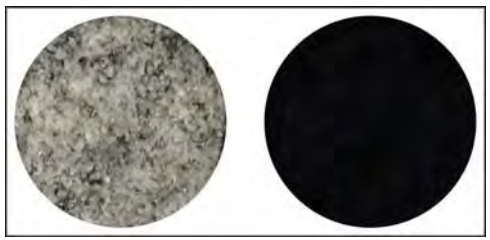
	5	4755.0	0.2	800.0	34.5	0.0	64.3	0.00	64.3		7.9	3
	Sd gy vf-mgr sslty-slty mica no stn no flor											
	6	4757.0	0.3	1300.0	33.9	0.0	69.2	0.00	69.2		9.1	3
	Sd gy vf-mgr sslty mica no stn no flor											
	7	4759.0	0.2	1500.0	35.1	0.0	64.4	0.00	64.4		4.8	3
	Sd gy vf-mgr sslty mica no stn no flor											
	8	4761.0	0.2	1400.0	34.8	0.0	76.2	0.00	76.2		7.2	3
	Sd gy vf-mgr sslty mica no stn no flor											

Company: Pacific Gas and Electric Co.
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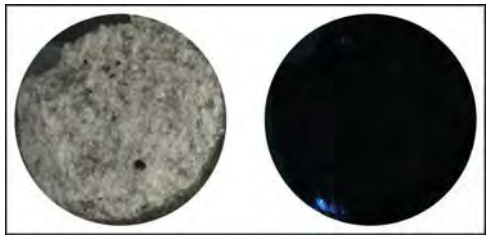
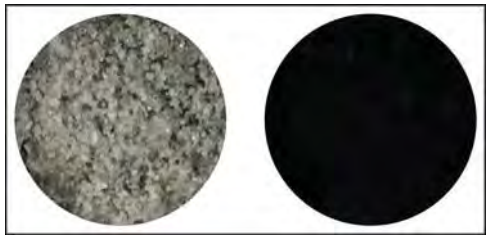
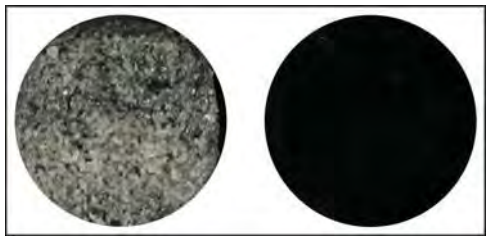
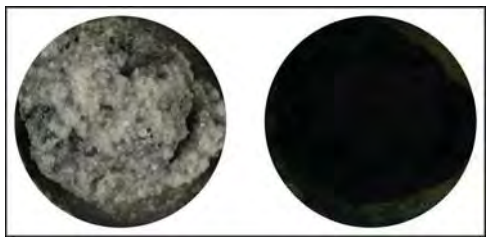
	9	4763.0	0.4	1381.4	33.6	0.0	87.3	0.00	87.3	2.63	10.1	1
	Sd gy vf-mgr sslty smica no stn no flor											
	10	4765.0	0.3	1694.7	31.8	0.0	97.4	0.00	97.4	2.62	12.8	1
	Sd gy vf-mgr sslty mica no stn no flor											
	11	4767.0	0.5	479.2	32.1	0.0	89.9	0.00	89.9	2.62	10.8	1
	Sd gy vf-mgr slty mica no stn no flor											
	12	4769.0	0.3	1200.0	34.8	0.0	91.4	0.00	91.4		5.4	3
	Sd gy vf-mgr sslty-slty smica no stn no flor											

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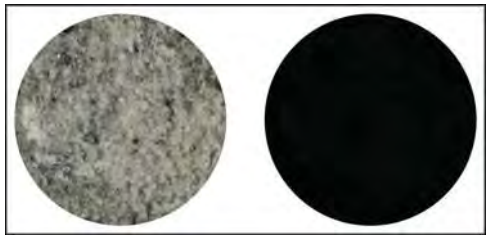
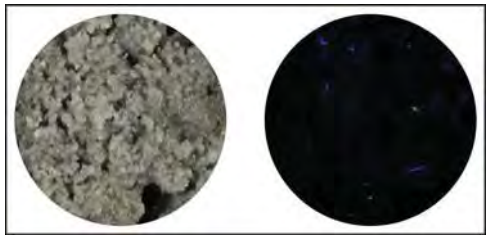
		4771.0	0.2									
Sd gy vf-mgr sslty smica no stn no flor												
		4773.0	0.1									
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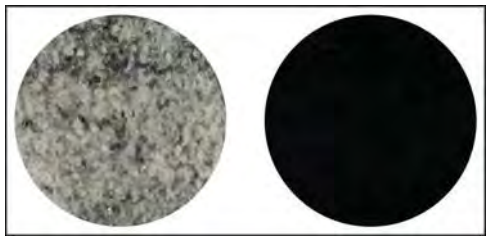
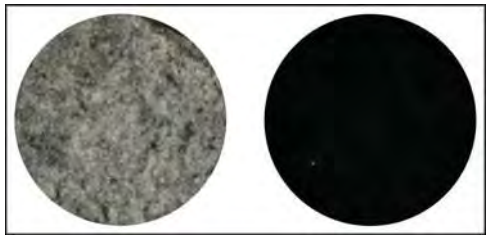
	13	4775.0	0.4	1300.0	34.7	0.0	92.5	0.00	92.5		5.4	3
Sd gy vf-mgr sslty no stn no flor												
	14	4777.0	0.3	700.0	31.4	0.0	98.5	0.00	98.5		4.4	3
Sd gy vf-mgr sslty-slty smica no stn no flor												

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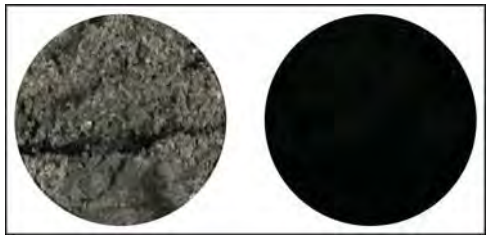
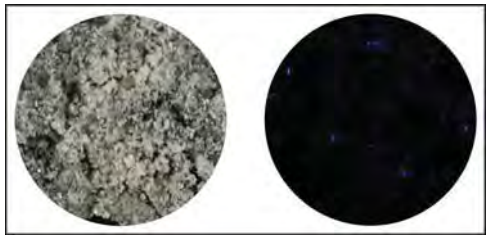
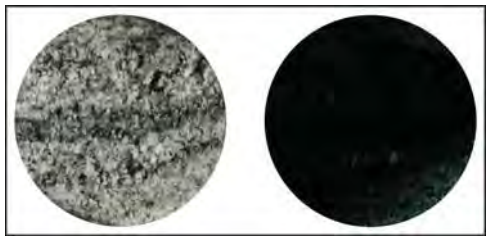
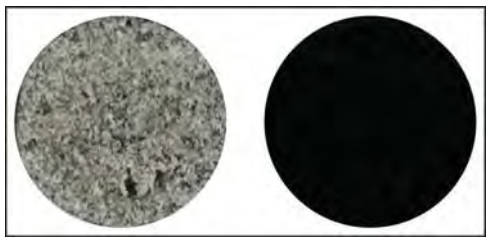
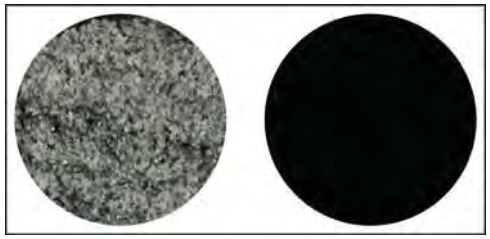
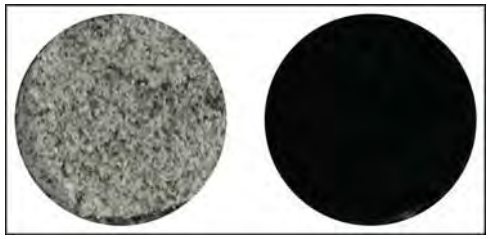
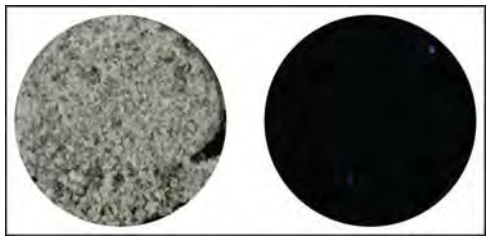
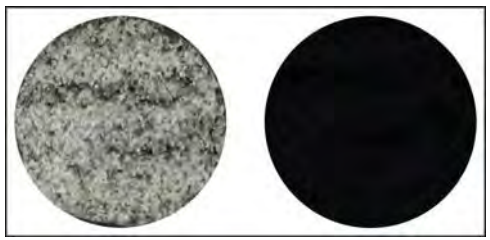
	15	4779.0	0.4	300.0	28.0	0.0	66.7	0.00	66.7		4.5	3
	Sd gy vf-mgr slty carb no stn no flor											
	16	4781.0	0.3	777.7	34.6	0.0	81.1	0.00	81.1	2.64	12.6	1
	Sd gy vf-mgr sslty-slty smica no stn no flor											
	17	4783.0	0.3	700.0	34.1	0.0	75.0	0.00	75.0		7.0	3
	Sd gy vf-mgr sslty-slty smica no stn no flor											
	18	4789.0	0.6	843.0	33.2	0.0	91.3	0.00	91.3	2.64	13.2	1
	Sd gy vf-mgr sslty-slty smica no stn no flor											

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-213161PG
API No.: 04-077-20736
Date: 4/9/2013

Sidewall Core Analysis Results

Core Images White Light | UV Light	Sample Number	Depth ft	Rec in	Perm. Kair md	Porosity %	Fluid Saturation Oil %	Water %	O/W Ratio	Total %	Grain Den g/cc	Sample Wt. g	Method
	19	4795.0	0.4	800.0	35.6	0.0	77.4	0.00	77.4		4.6	3
	Sd gy vf-mgr sslty-slty smica no stn no flor											
	20	4803.0	0.3	807.4	35.1	0.0	91.9	0.00	91.9	2.64	11.2	1
	Sd gy vf-mgr sslty-slty smica no stn no flor											
	21	4805.0	0.3	879.3	33.4	0.0	87.7	0.00	87.7	2.64	12.6	1
	Sd gy vf-mgr sslty-slty no stn no flor											
	22	4809.0	0.2	1171.6	34.8	0.0	87.1	0.00	87.1	2.63	13.6	1
	Sd gy vf-mgr sslty-slty mica no stn no flor											

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island

File No.: 57111-213161PG
API No.: 04-077-20736
Date: 4/9/2013
Core Type: Sidewall Core

Core Analysis Procedures and Conditions

	Procedure (1)	Procedure (2)	Procedure (3)	Procedure (4)
Sampling Method	Percussion	Percussion	Percussion	Rotary
Drill Coolant	N/A	N/A	N/A	N/A
Jacket Material	Nickel	None	N/A	None
Saturation Method	Dean Stark (Toluene)	Dean Stark (Toluene)	Retort	Dean Stark (Toluene)
Porosity Method				
Grain Volume	Boyle's Law (Helium)	Boyle's Law (Helium)	Bulk Vol-Pore Vol	Boyle's Law (Helium)
Pore Volume	Boyle's Law (Helium)	Bulk Vol-Grain Vol	Summation Of Fluids	Bulk Vol-Grain Vol
Bulk Volume	Pore Vol + Grain Vol	Mercury Displacement	Mercury Displacement	Mercury Displacement
Permeability Method	Air	Empirical	Empirical	Air

Common Conditions

Sleeved Sample Seating Pressure: N/A

Confining Pressure Pore Vol & Permeability:

Samples Dried At 235 Degrees Fahrenheit

Additional Extraction by Soxhlet with Methylene Chloride/Methanol

Oil Density used in Calculation: 0.97g/cc

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
1	4641.5	6194.2	35.4	0.0	61.8	0.00	61.8	1.90	2.62	2	Sd gy vf-mgr sslty no stn no flor
2	4642.6	12931.7	34.1	0.0	66.3	0.00	66.3	1.95	2.63	2	Sd gy vf-cgr sslty no stn no flor
3	4643.5	1375.5	33.8	0.0	86.2	0.00	86.2	2.05	2.67	2	Sd gy vf-fgr sslty-slty smica no stn no flor
4	4644.5	3272.1	35.5	0.0	89.2	0.00	89.2	2.02	2.65	2	Sd gy vf-fgr sslty no stn no flor
5	4645.5	312.6	32.5	0.0	84.1	0.00	84.1	2.06	2.66	2	Sd gy vf-fgr slty no stn no flor
6	4646.5	779.1	33.5	0.0	84.4	0.00	84.4	2.03	2.65	2	Sd gy vf-mgr slty-sslty smica no stn no flor
7	4647.5	1119.3	33.8	0.0	83.0	0.00	83.0	2.03	2.65	2	Sd gy vf-fgr sslty-slty smica no stn no flor
8	4648.5	2104.8	33.0	0.0	77.1	0.00	77.1	2.02	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
9	4649.5	809.7	34.9	0.0	85.2	0.00	85.2	2.02	2.65	2	Sd gy vf-fgr sslty-slty smica no stn no flor
10	4650.5	1462.9	33.0	0.0	83.5	0.00	83.5	2.03	2.64	2	Sd gy vf-mgr sslty-slty smica no stn no flor
11	4651.5	962.5	33.7	0.0	80.9	0.00	80.9	2.02	2.65	2	Sd gy vf-fgr sslty-slty smica no stn no flor
12	4652.5	456.3	31.9	0.0	85.0	0.00	85.0	2.06	2.64	2	Sd gy vf-fgr slty smica no stn no flor
13	4653.5	0.10	4.8	0.0	30.8	0.00	30.8	2.62	2.73	3	Sst gy vf-fgr slty vcalc no stn no flor
14	4654.5 F/	498.8	31.6	0.0	99.8	0.00	99.8	2.14	2.68	2	Cly gy slty no stn no flor
15	4655.5 F/	55.9	28.9	0.0	99.7	0.00	99.7	2.25	2.77	2	Cly gy slty calc smica no stn no flor
16	4656.5 F/	385.7	30.7	0.0	99.5	0.00	99.5	2.17	2.70	2	Cly gy slty calc no stn no flor
17	4657.5 F/	68.6	30.3	0.0	98.4	0.00	98.4	2.17	2.69	2	Cly gy slty calc no stn no flor
18	4658.5 F/	771.2	28.7	0.0	99.4	0.00	99.4	2.20	2.69	2	Cly gy slty calc no stn no flor
19	4659.5 F/	380.9	28.7	0.0	99.8	0.00	99.8	2.23	2.74	2	Cly gy slty calc no stn no flor
20	4660.5 F/	246.2	29.1	0.0	99.6	0.00	99.6	2.18	2.68	2	Cly gy slty calc no stn no flor
21	4661.5 F/	622.1	28.9	0.0	99.6	0.00	99.6	2.19	2.68	2	Cly gy slty calc no stn no flor
22	4662.5 F/	50.6	30.4	0.0	99.9	0.00	99.9	2.17	2.70	2	Cly gy slty calc no stn no flor
23	4666.5 F/	40.2	24.6	0.0	99.5	0.00	99.5	2.26	2.69	2	Cly gy slty calc no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
24	4667.5	0.45	26.1	0.0	99.2	0.00	99.2	2.23	2.69	2	Cly gy slty calc no stn no flor
25	4668.5 F/	158.0	31.1	0.0	89.3	0.00	89.3	2.12	2.69	2	Cly gy slty calc no stn no flor
26	4669.5 F/	158.4	29.1	0.0	99.0	0.00	99.0	2.19	2.69	2	Cly gy slty calc no stn no flor
27	4670.5 F/	53.4	30.4	0.0	99.1	0.00	99.1	2.16	2.68	2	Cly gy slty calc no stn no flor
28	4671.5 F/	278.3	30.1	0.0	95.7	0.00	95.7	2.16	2.69	2	Cly gy slty calc no stn no flor
29	4672.5	0.98	28.2	0.0	99.1	0.00	99.1	2.20	2.69	2	Slt gy vcly calc fos scarb no stn no flor
30	4673.5 F/	114.3	31.0	0.0	92.5	0.00	92.5	2.13	2.68	2	Cly gy vslty calc no stn no flor
31	4674.5	0.19	29.4	0.0	99.9	0.00	99.9	2.21	2.73	2	Mdst gy-grn sdy vslty calc fos no stn no flor
32	4675.5	0.051	28.1	0.0	99.5	0.00	99.5	2.23	2.73	2	Mdst gy-grn sdy vslty calc fos no stn no flor
33	4676.5	0.45	27.3	0.0	99.6	0.00	99.6	2.24	2.72	2	Mdst gy-grn sdy vslty calc fos no stn no flor
34	4677.5	0.13	27.4	0.0	99.4	0.00	99.4	2.23	2.71	2	Sltst gy-grn sdy vcly calc no stn no flor
35	4678.5	0.66	27.1	0.0	99.6	0.00	99.6	2.26	2.74	2	Sltst gy-grn sdy vcly scalc no stn no flor
36	4679.5	0.21	26.9	0.0	99.3	0.00	99.3	2.25	2.73	2	Mdst gy-grn vslty calc fos no stn no flor
37	4680.5	0.050	13.9	0.0	98.5	0.00	98.5	2.51	2.76	3	Mdst gy-grn vslty calc fos no stn no flor
38	4681.5	3.0	24.5	0.0	97.3	0.00	97.3	2.39	2.86	2	Sst grn-gy vf-cgr/gran vslty vcly pyt fos no stn no flor
39	4682.5	1.1	26.7	0.0	96.3	0.00	96.3	2.38	2.91	2	Sst grn-gy vf-pbly vslty vcly fos no stn no flor
40	4683.3	9.9	27.2	0.0	84.8	0.00	84.8	2.22	2.75	2	Cong gy-grn vf-pbly vslty vcly scalc no stn no flor
41	4684.5 F/	202.6	25.6	0.0	92.4	0.00	92.4	2.23	2.69	2	Cong gy-grn vf-pbly vslty cly calc no stn no flor
42	4687.6 F/	4.8	25.4	0.0	99.5	0.00	99.5	2.22	2.65	2	Mdst gy vslty smica no stn no flor
43	4688.5	1.4	24.1	0.0	99.5	0.00	99.5	2.23	2.64	2	Mdst gy vslty smica no stn no flor
44	4689.5	14.6	28.3	0.0	88.2	0.00	88.2	2.23	2.77	2	Sd gy vfgr vslty vcly smica no stn no flor
45	4690.5	2.8	23.9	0.0	99.4	0.00	99.4	2.26	2.67	2	Mdst gy vslty smica no stn no flor
46	4691.5 F/	73.6	22.8	0.0	99.6	0.00	99.6	2.29	2.69	2	Mdst gy vslty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
47	4692.5	2.4	27.2	0.0	91.9	0.00	91.9	2.24	2.74	2	Sd gy vfgr vslty cly mica no stn no flor
48	4693.5	6.8	25.7	0.0	84.2	0.00	84.2	2.18	2.65	2	Slt gy sdy vcly smica no stn no flor
49	4694.5	3.4	25.1	0.0	99.5	0.00	99.5	2.25	2.68	2	Sd gy vfgr vslty cly mica no stn no flor
50	4695.5 F/	767.8	38.5	0.0	99.2	0.00	99.2	2.02	2.68	2	Sd gy vf-fgr slty mica scalc no stn no flor
51	4696.5	152.5	32.2	0.0	73.2	0.00	73.2	2.02	2.64	2	Sd gy vfgr vslty smica no stn no flor
52	4697.8 F/	38.0	26.0	0.0	99.6	0.00	99.6	2.20	2.63	2	Slt gy sd lams vcly smica no stn no flor
53	4698.5 F/	58.9	32.9	0.0	83.6	0.00	83.6	2.05	2.65	2	Sd gy vfgr vslty scly smica no stn no flor
54	4699.5	79.1	31.0	0.0	92.4	0.00	92.4	2.11	2.66	2	Sd gy vfgr vslty scly mica no stn no flor
55	4701.5	0.42	24.4	0.0	99.9	0.00	99.9	2.22	2.63	2	Mdst vslty no stn no flor
56	4702.5	0.11	22.1	0.0	99.7	0.00	99.7	2.27	2.64	2	Sltst gy sdy vcly smica no stn no flor
57	4703.5	28.4	27.5	0.0	94.8	0.00	94.8	2.17	2.65	2	Sd gy vfgr vslty scly mica no stn no flor
58	4704.5	225.1	34.2	0.0	84.6	0.00	84.6	2.05	2.68	2	Sd gy vf-fgr slty-vslty smica no stn no flor
59	4705.5	0.049	24.8	0.0	99.5	0.00	99.5	2.24	2.66	2	Mdst slty no stn no flor
60	4706.5	0.57	22.7	0.0	99.8	0.00	99.8	2.25	2.63	2	Mdst slty smica no stn no flor
61	4707.5	0.26	23.6	0.0	99.1	0.00	99.1	2.24	2.64	2	Slt gy vsdy vcly mica no stn no flor
62	4708.5	0.028	22.8	0.0	99.6	0.00	99.6	2.29	2.68	2	Mdst gy vslty no stn no flor
63	4709.5	0.44	22.6	0.0	99.4	0.00	99.4	2.30	2.69	2	Sltst gy ssdy vcly no stn no flor
64	4710.5	0.70	23.1	0.0	99.4	0.00	99.4	2.25	2.64	2	Mdst gy vslty smica no stn no flor
65	4711.5	0.95	24.3	0.0	99.4	0.00	99.4	2.24	2.65	2	Mdst gy vslty smica no stn no flor
66	4712.5	7.7	27.7	0.0	88.2	0.00	88.2	2.15	2.65	2	Sd gy vfgr vslty cly mica no stn no flor
67	4713.5	0.014	24.0	0.0	99.2	0.00	99.2	2.22	2.62	2	Mdst dgy slty no stn no flor
68	4714.5	1.5	23.8	0.0	99.6	0.00	99.6	2.24	2.64	2	Mdst gy vslty smica no stn no flor
69	4715.5	1.3	24.8	0.0	95.2	0.00	95.2	2.19	2.62	2	Slt gy vsdy vcly mica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
70	4716.5 F/	3.8	24.0	0.0	99.7	0.00	99.7	2.25	2.66	2	Sltst gy sdy vcly smica no stn no flor
71	4717.5	0.026	1.6	0.0	98.2	0.00	98.2	2.78	2.81	3	Mdst gy slty vcalc no stn no flor
72	4718.5 F/	17.0	29.9	0.0	88.5	0.00	88.5	2.13	2.67	2	Slt gy ssdy vcly smica no stn no flor
73	4719.5	35.7	30.6	0.0	90.6	0.00	90.6	2.11	2.65	2	Sd gy vfgr vslty scly mica no stn no flor
74	4720.5	122.1	32.5	0.0	82.1	0.00	82.1	2.04	2.63	2	Sd gy vf-fgr vslty scly mica no stn no flor
75	4721.5	169.8	33.6	0.0	82.3	0.00	82.3	2.02	2.64	2	Sd gy vf-fgr vslty scly mica no stn no flor
76	4722.5 F/	845.7	36.0	0.0	87.3	0.00	87.3	1.90	2.49	2	Sd gy vf-fgr slty cly vcarb mica no stn no flor
77	4723.5	854.7	34.1	0.0	68.1	0.00	68.1	1.96	2.63	2	Sd gy vf-fgr slty-sslty smica no stn no flor
78	4724.5	476.3	33.1	0.0	83.0	0.00	83.0	2.03	2.63	2	Sd gy vf-fgr slty smica no stn no flor
79	4725.5	465.1	32.0	0.0	76.2	0.00	76.2	2.08	2.71	2	Sd gy vf-fgr slty smica no stn no flor
80	4726.3	250.6	33.9	0.0	72.6	0.00	72.6	1.98	2.64	2	Sd gy vfgr slty smica no stn no flor
81	4727.5 F/	30.2	25.4	0.0	99.5	0.00	99.5	2.19	2.61	2	Mdst gy vslty smica scarb no stn no flor
82	4728.5	0.014	22.3	0.0	99.6	0.00	99.6	2.26	2.63	2	Mdst gy vslty no stn no flor
83	4729.5	0.11	23.3	0.0	99.7	0.00	99.7	2.26	2.66	2	Mdst gy slty no stn no flor
84	4730.5	0.028	23.1	0.0	98.7	0.00	98.7	2.29	2.69	2	Mdst gy slty no stn no flor
85	4731.5	68.2	30.0	0.0	99.8	0.00	99.8	2.17	2.69	2	Sd gy vfgr vslty scly mica no stn no flor
86	4732.5	2.1	26.8	0.0	98.7	0.00	98.7	2.21	2.67	2	Slt gy vsdy cly mica no stn no flor
87	4733.5	23.0	31.9	0.0	95.7	0.00	95.7	2.11	2.67	2	Sd gy vfgr vslty cly mica no stn no flor
88	4734.5	16.3	31.7	0.0	95.8	0.00	95.8	2.10	2.64	2	Sd gy vfgr vslty cly mica no stn no flor
89	4735.5	0.81	28.2	0.0	99.6	0.00	99.6	2.17	2.64	2	Mdst gy vslty no stn no flor
90	4736.5 F/	2.3	25.9	0.0	99.3	0.00	99.3	2.21	2.64	2	Mdst gy vslty no stn no flor
91	4737.5 F/	13.1	28.1	0.0	91.0	0.00	91.0	2.15	2.65	2	Slt gy ssdy vcly smica no stn no flor
92	4738.5	0.052	23.7	0.0	99.9	0.00	99.9	2.25	2.64	2	Mdst gy-dgy vslty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
93	4739.5 F/	135.7	26.5	0.0	99.3	0.00	99.3	2.19	2.63	2	Mdst gy-dgy vslty smica no stn no flor
94	4740.5 F/	10.2	24.8	0.0	99.5	0.00	99.5	2.28	2.71	2	Mdst gy vslty no stn no flor
95	4741.5 F/	70.9	24.0	0.0	99.4	0.00	99.4	2.29	2.71	2	Mdst gy vslty no stn no flor
96	4742.5	4.8	23.9	0.0	97.8	0.00	97.8	2.27	2.68	2	Slt gy ssdy vcly smica no stn no flor
97	4743.5	8.1	26.9	0.0	92.2	0.00	92.2	2.18	2.65	2	Slt gy sdy cly smica no stn no flor
98	4744.5	238.0	33.6	0.0	86.6	0.00	86.6	2.04	2.65	2	Sd gy vf-fgr slty-vslty smica no stn no flor
99	4745.5 F/	3.0	28.3	0.0	99.8	0.00	99.8	2.14	2.60	2	Mdst dgy vslty carb smica no stn no flor
100	4746.5	1.9	27.2	0.0	99.9	0.00	99.9	2.19	2.64	2	Sltst gy ssdy vcly smica no stn no flor
101	4747.5	1.4	26.2	0.0	99.9	0.00	99.9	2.14	2.56	2	Mdst dgy vslty carb smica no stn no flor
102	4748.5 F/	192.9	27.7	0.0	99.5	0.00	99.5	1.94	2.31	2	Mdst dgy vslty vcarb smica no stn no flor
103	4749.5	29.6	31.0	0.0	90.5	0.00	90.5	2.09	2.63	2	Sd gy vfgr vslty cly mica no stn no flor
104	4750.5 F/	33.4	26.0	0.0	96.7	0.00	96.7	2.21	2.66	2	Sst gy vfgr slty mica lmtd no stn no flor
105	4751.5	0.40	26.5	0.0	99.4	0.00	99.4	2.18	2.63	2	Mdst dgy slty no stn no flor
106	4752.5	4.1	26.3	0.0	99.3	0.00	99.3	2.19	2.63	2	Sltst dgy vcly mica no stn no flor
107	4753.5	1.5	26.3	0.0	99.1	0.00	99.1	2.20	2.64	2	Sltst dgy vcly smica no stn no flor
108	4754.5	0.77	26.3	0.0	99.5	0.00	99.5	2.20	2.64	2	Mdst dgy vslty smica no stn no flor
109	4755.5	1475.7	32.7	0.0	70.3	0.00	70.3	2.01	2.66	2	Sd gy vf-fgr sslty-slty smia scarb no stn no flor
110	4756.5	3063.5	34.5	0.0	66.1	0.00	66.1	1.95	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
111	4757.5	3709.7	34.9	0.0	60.2	0.00	60.2	1.93	2.65	2	Sd gy vf-mgr sslty mica no stn no flor
112	4758.5	5333.6	35.7	0.0	50.2	0.00	50.2	1.84	2.59	2	Sd gy vf-fgr sslty mica no stn no flor
113	4759.5	6521.5	35.4	0.0	52.3	0.00	52.3	1.88	2.63	2	Sd gy vf-mgr sslty smica no stn no flor
114	4760.5	7758.9	38.1	0.0	45.2	0.00	45.2	1.79	2.63	2	Sd gy vf-mgr sslty smica no stn no flor
115	4761.5	19736.7	35.5	0.0	31.7	0.00	31.7	1.80	2.63	2	Sd gy vf-cgr sslty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
116	4762.5	4926.5	34.0	0.0	78.4	0.00	78.4	1.99	2.63	2	Sd gy vf-cgr sslty smica no stn no flor
117	4763.5	4345.4	33.9	0.0	82.3	0.00	82.3	2.01	2.63	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
118	4764.5	4604.9	35.7	0.0	64.5	0.00	64.5	1.91	2.63	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
119	4765.5	4760.9	35.4	0.0	67.8	0.00	67.8	1.93	2.62	2	Sd gy vf-cgr sslty mica no stn no flor
120	4766.5	13229.0	35.9	0.0	74.0	0.00	74.0	1.94	2.62	2	Sd gy vf-mgr sslty mica no stn no flor
121	4767.5	12954.9	35.1	0.0	72.5	0.00	72.5	1.95	2.62	2	Sd gy vf-mgr sslty mica no stn no flor
122	4768.5	3183.2	33.6	0.0	68.0	0.00	68.0	1.93	2.58	2	Sd gy vf-mgr sslty mica lam (resin Contamination)
123	4769.5	3407.1	30.2	0.0	48.9	0.00	48.9	1.86	2.47	2	Sd gy vf-mgr sslty mica (resin Contamination)
124	4770.5	13197.8	36.3	0.0	53.3	0.00	53.3	1.86	2.63	2	Sd gy vf-mgr sslty smica no stn no flor
125	4771.5	18985.0	34.8	0.0	60.7	0.00	60.7	1.92	2.63	2	Sd gy vf-mgr sslty smica no stn no flor
126	4772.5	13691.1	36.3	0.0	49.6	0.00	49.6	1.85	2.63	2	Sd gy vf-cgr sslty smica no stn no flor
127	4773.5	17328.8	34.6	0.0	58.2	0.00	58.2	1.91	2.62	2	Sd gy vf-mgr sslty smica no stn no flor
128	4774.7	22855.6	36.8	0.0	40.2	0.00	40.2	1.79	2.61	2	Sd gy vf-mgr sslty smica no stn no flor
129	4775.5	19087.1	35.6	0.0	44.8	0.00	44.8	1.84	2.62	2	Sd gy vf-mgr sslty smica no stn no flor
130	4776.8	19236.8	35.6	0.0	40.2	0.00	40.2	1.83	2.63	2	Sd gy vf-mgr sslty smica no stn no flor
131	4777.5	19236.3	33.9	0.0	35.4	0.00	35.4	1.90	2.70	2	Sd gy vf-cgr sslty smica no stn no flor
132	4778.5	5514.1	33.6	0.0	59.9	0.00	59.9	2.02	2.74	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
133	4779.5	3451.7	34.1	0.0	68.6	0.00	68.6	1.96	2.63	2	Sd gy vf-fgr sslty smica no stn no flor
134	4780.5	3745.0	34.3	0.0	54.2	0.00	54.2	1.91	2.63	2	Sd gy vf-fgr sslty smica no stn no flor
135	4781.5	4148.9	34.8	0.0	51.6	0.00	51.6	1.89	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
136	4782.5	1074.8	32.0	0.0	69.9	0.00	69.9	2.01	2.64	2	Sd gy vf-mgr sslty-slty mica no stn no flor
137	4783.5	602.5	31.8	0.0	75.2	0.00	75.2	2.03	2.63	2	Sd gy vf-fgr slty-sslty mica no stn no flor
138	4784.5	3749.0	33.1	0.0	53.5	0.00	53.5	1.93	2.63	2	Sd gy vf-mgr sslty mica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
139	4785.5	863.6	31.5	0.0	60.1	0.00	60.1	1.98	2.62	2	Sd gy vf-mgr slty-sslty mica no stn no flor
140	4786.5	3359.4	34.7	0.0	55.3	0.00	55.3	1.90	2.63	2	Sd gy vf-fgr sslty mica no stn no flor
141	4787.5	1577.2	35.6	0.0	63.9	0.00	63.9	1.92	2.64	2	Sd gy vf-fgr sslty-slty mica no stn no flor
142	4788.5	1133.6	35.7	0.0	62.5	0.00	62.5	1.92	2.65	2	Sd gy vf-fgr sslty-slty mica no stn no flor
143	4790.2	2907.3	36.0	0.0	86.5	0.00	86.5	1.99	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
144	4791.2	5283.8	34.3	0.0	75.1	0.00	75.1	1.98	2.62	2	Sd gy vf-fgr sslty smica no stn no flor
145	4792.2	14376.7	44.1	0.0	99.7	0.00	99.7	1.76	2.38	2	Sd gy-blk vf-mgr sslty smica vcarb no stn no flor
146	4793.2	6898.2	33.6	0.0	78.8	0.00	78.8	2.00	2.63	2	Sd gy vf-mgr sslty smica no stn no flor
147	4794.2	4047.7	34.6	0.0	85.2	0.00	85.2	2.01	2.63	2	Sd gy vf-mgr sslty mica no stn no flor
148	4795.2	4631.9	33.6	0.0	90.0	0.00	90.0	2.05	2.64	2	Sd gy vf-cgr sslty mica no stn no flor
149	4796.2 F/	12667.0	55.3	0.0	99.9	0.00	99.9	1.46	2.04	2	Slt blk cly vcarb no stn no flor
150	4797.2	20634.2	37.1	0.0	51.3	0.00	51.3	1.85	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
151	4798.2	1043.8	32.7	0.0	91.7	0.00	91.7	2.08	2.65	2	Sd gy vf-fgr sslty-slty smica no stn no flor
152	4799.2	1864.4	34.0	0.0	94.7	0.00	94.7	2.06	2.65	2	Sd gy vf-fgr sslty mica no stn no flor
153	4800.2	3528.3	35.5	0.0	79.7	0.00	79.7	2.08	2.80	2	Sd gy-dgy vf-mgr sslty vmica no stn no flor
154	4801.2	5937.6	36.7	0.0	69.6	0.00	69.6	1.92	2.64	2	Sd gy vf-fgr/vcgr sslty smica no stn no flor
155	4802.5	6487.3	36.9	0.0	85.6	0.00	85.6	1.97	2.63	2	Sd gy vf-fgr sslty smica no stn no flor
156	4803.5	4380.4	36.2	0.0	90.2	0.00	90.2	2.01	2.65	2	Sd gy vf-fgr sslty smica no stn no flor
157	4804.5	5655.0	36.6	0.0	82.3	0.00	82.3	1.97	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
158	4805.5	11882.6	36.7	0.0	62.1	0.00	62.1	1.89	2.63	2	Sd gy vf-fgr sslty smica no stn no flor
159	4806.5	4233.0	35.8	0.0	87.8	0.00	87.8	2.03	2.68	2	Sd gy vf-fgr sslty mica no stn no flor
160	4807.5	2929.5	34.5	0.0	89.3	0.00	89.3	2.05	2.66	2	Sd gy vf-mgr sslty mica no stn no flor
161	4808.5	11376.2	36.3	0.0	62.1	0.00	62.1	1.89	2.63	2	Sd gy vf-fgr sslty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas and Electric Co.
Well: Piacentine 2-27
Field: King Island Gas

Location: Sec. 27-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113011PG
API No.: 04-077-20736
Date: 4/28/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
162	4809.5	8176.6	36.1	0.0	70.3	0.00	70.3	1.93	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
163	4810.5	5534.8	35.0	0.0	85.1	0.00	85.1	2.01	2.65	2	Sd gy vf-mgr sslty mica no stn no flor
164	4811.5	8459.1	35.5	0.0	80.8	0.00	80.8	1.98	2.63	2	Sd gy vf-fgr sslty smica no stn no flor
165	4812.5	13347.1	33.7	0.0	75.9	0.00	75.9	1.99	2.63	2	Sd gy vf-fgr sslty smica no stn no flor
166	4813.5	5718.5	35.5	0.0	61.5	0.00	61.5	1.91	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
167	4814.5	8055.9	36.7	0.0	57.8	0.00	57.8	1.88	2.64	2	Sd gy vf-mgr sslty mica no stn no flor
168	4815.5 F/	186.6	25.5	0.0	99.8	0.00	99.8	2.09	2.48	2	Sltst dgy-blk vsdy cly carb no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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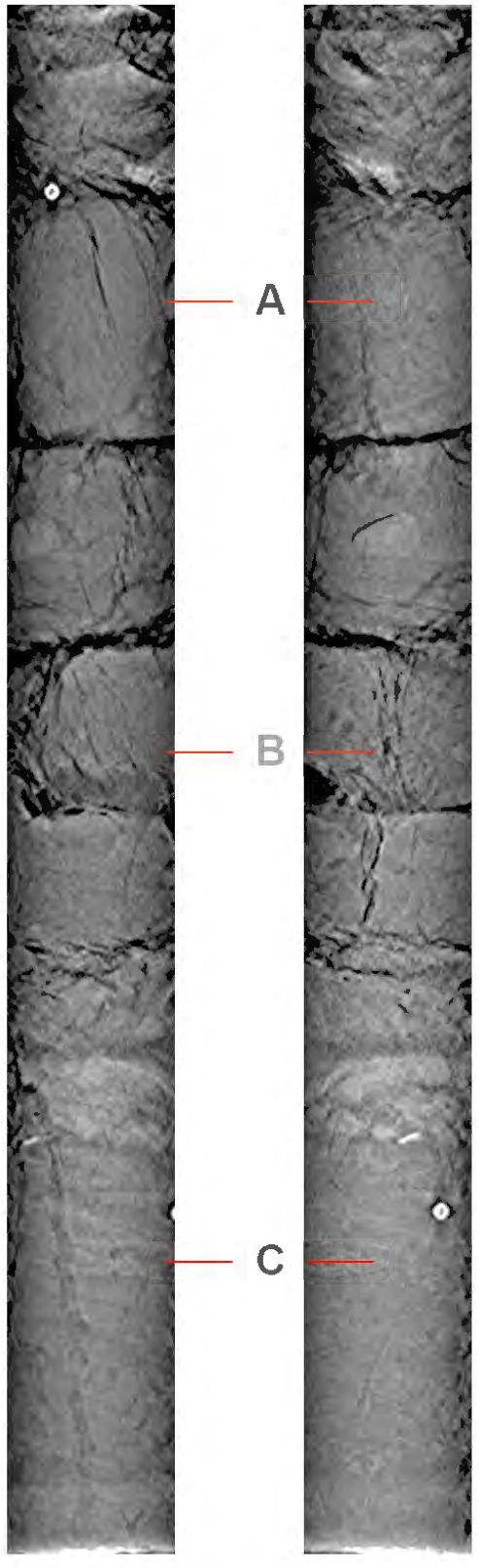



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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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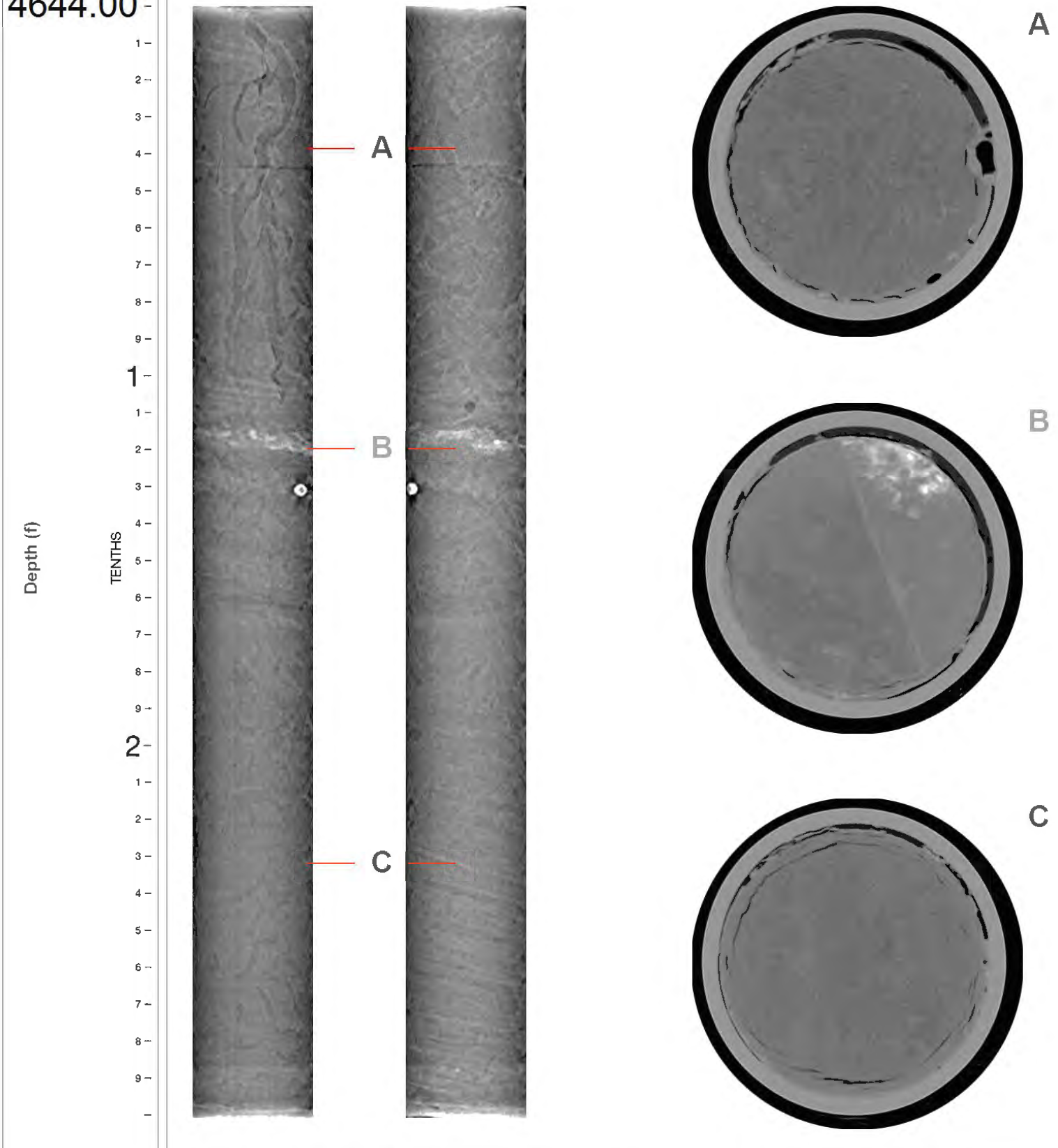

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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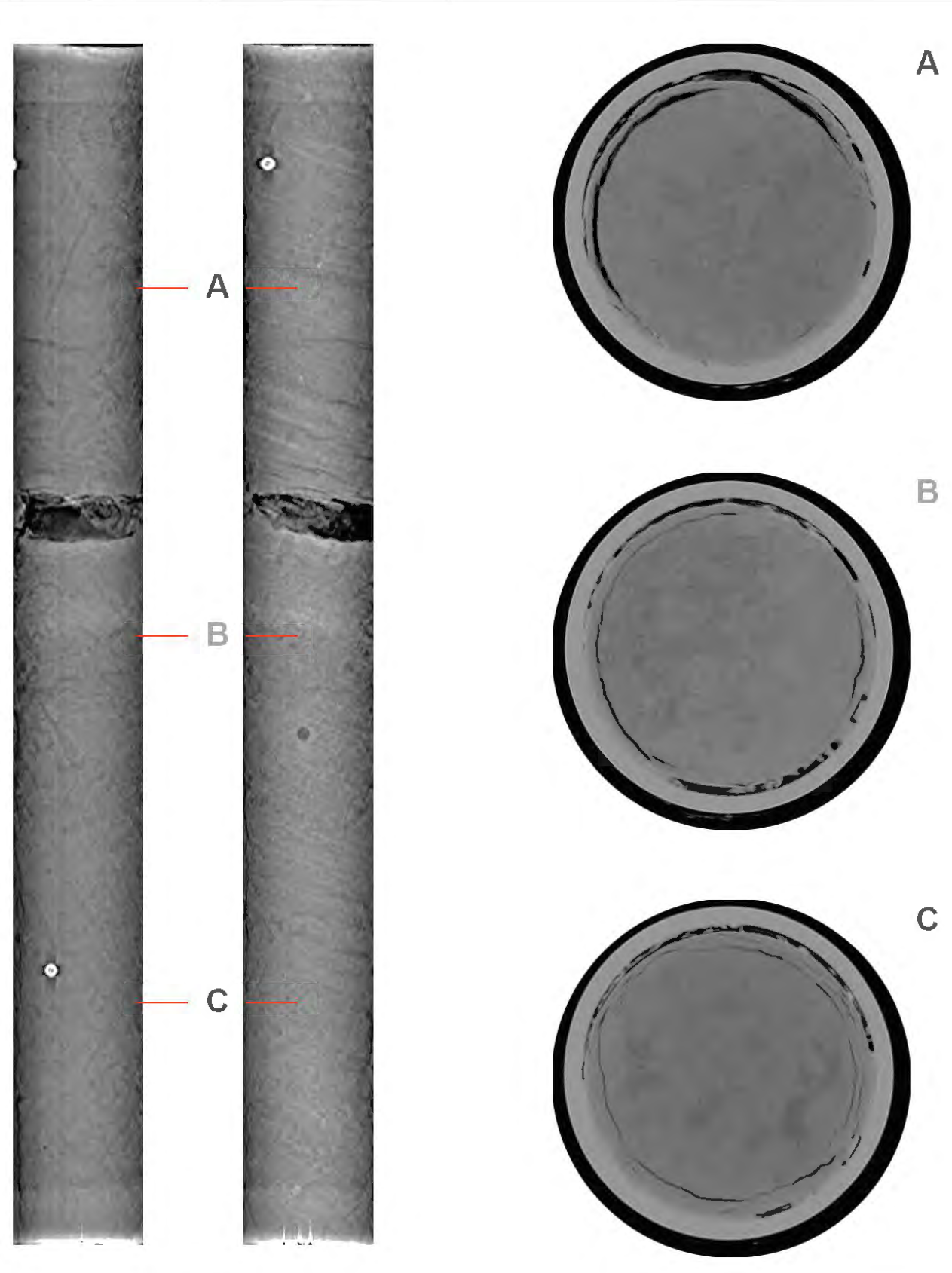

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Pacific Gas and Electric Company

Piacentine 2-27

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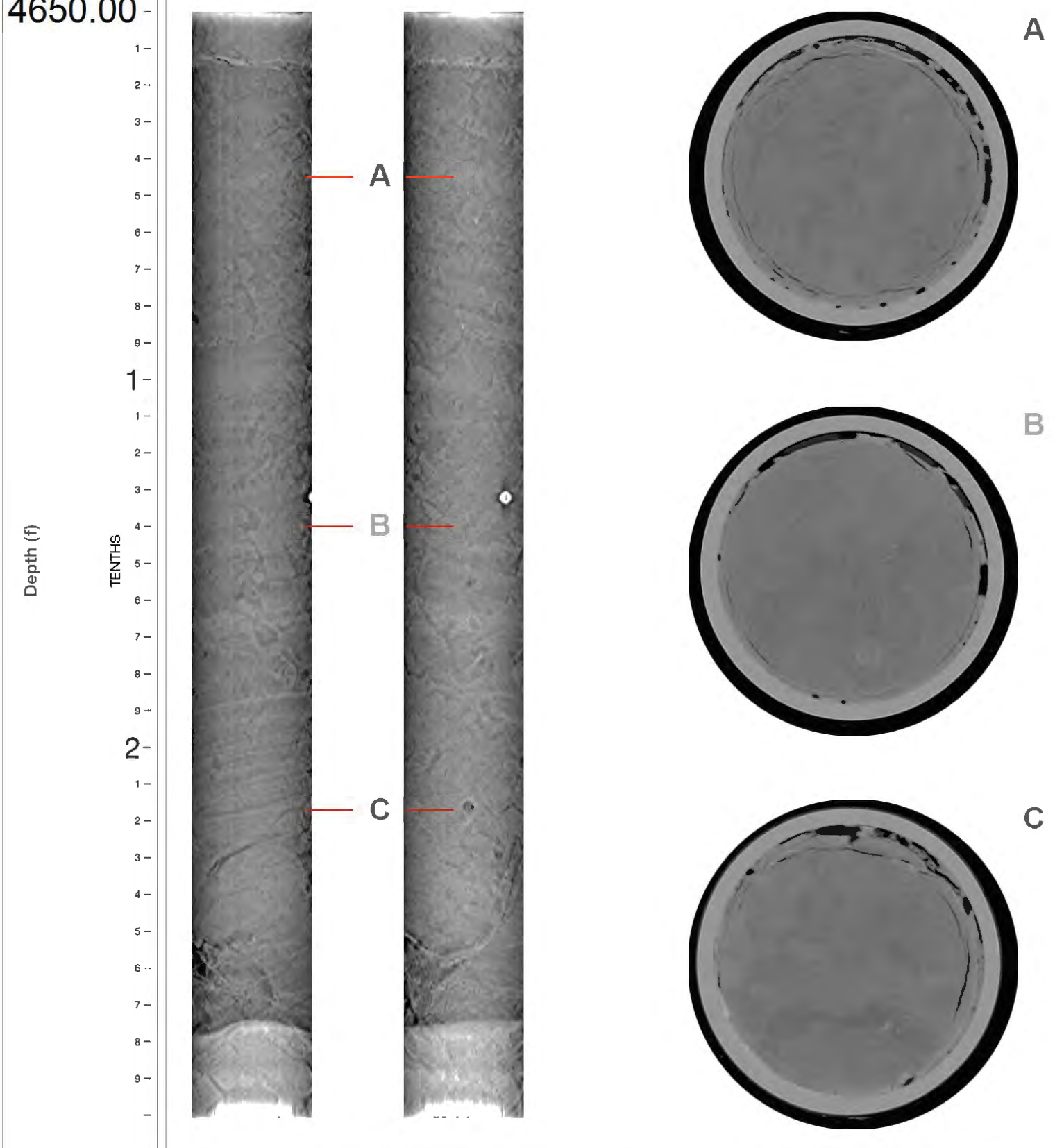

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Piacentine 2-27

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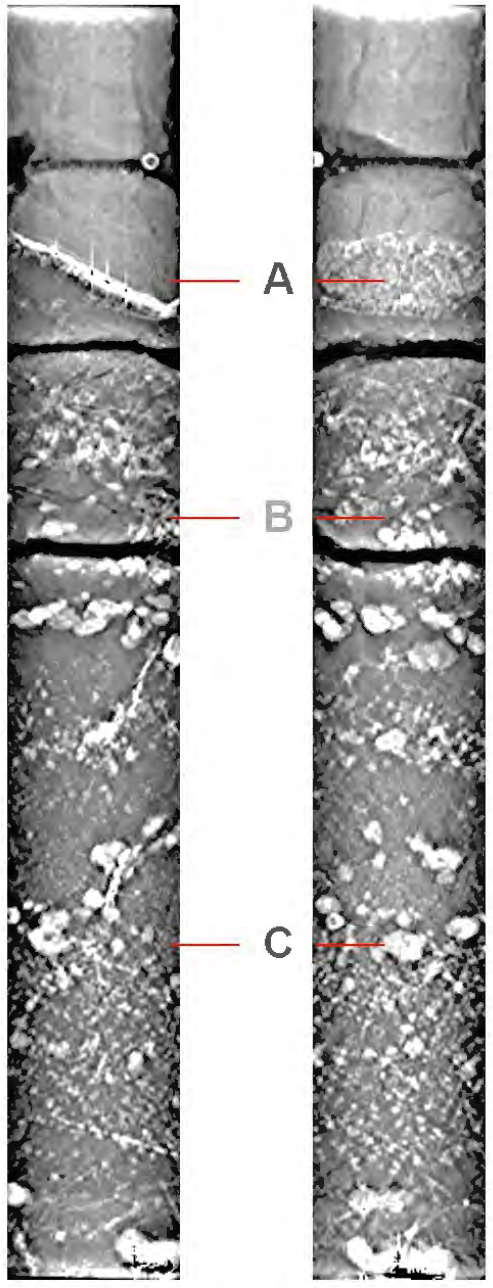

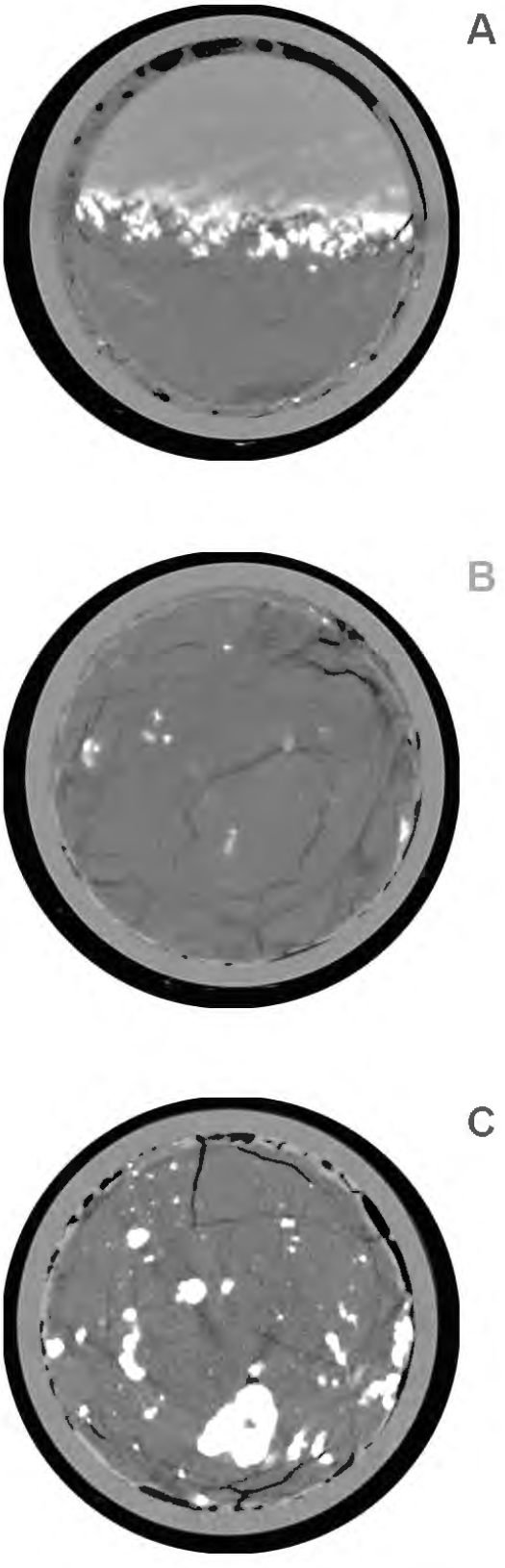

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Pacific Gas and Electric Company

Piacentine 2-27

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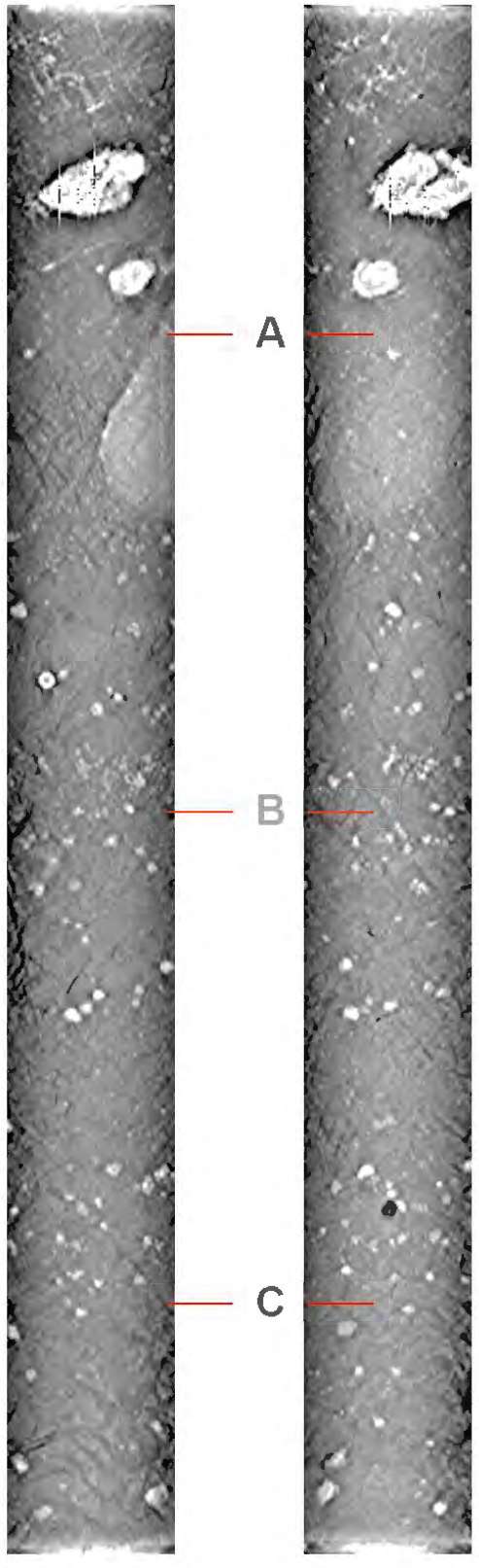

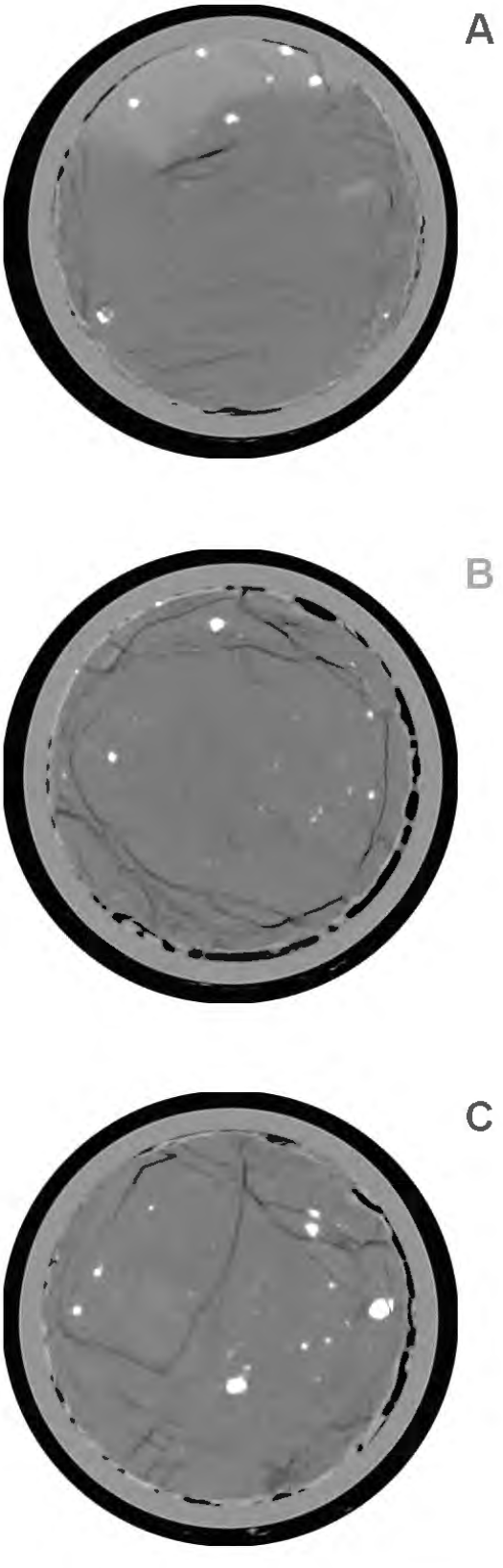

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Pacific Gas and Electric Company

Piacentine 2-27

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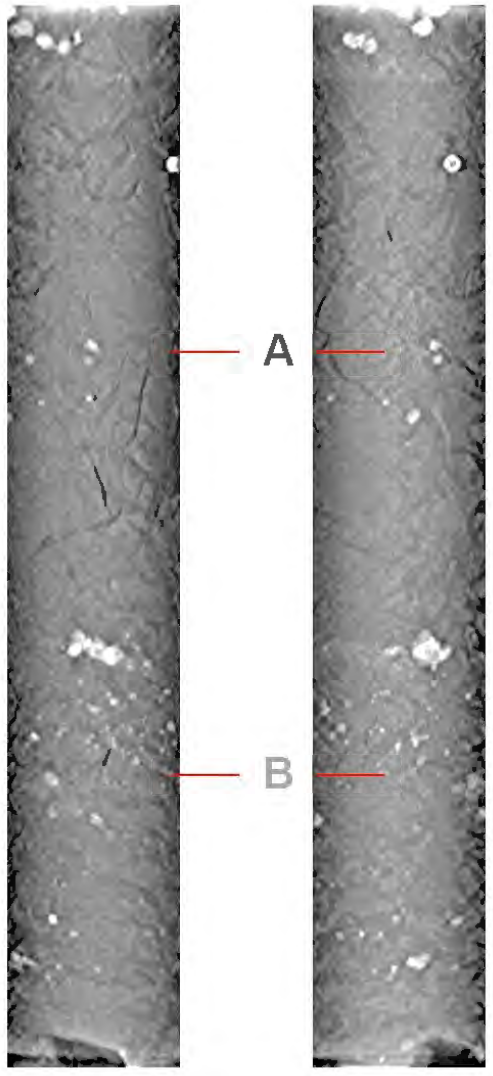

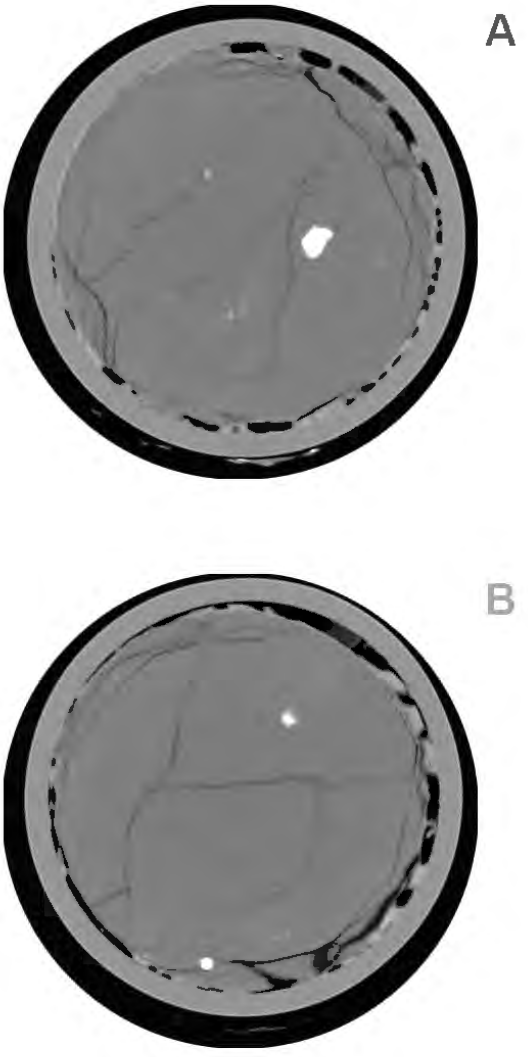

Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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TENTHS

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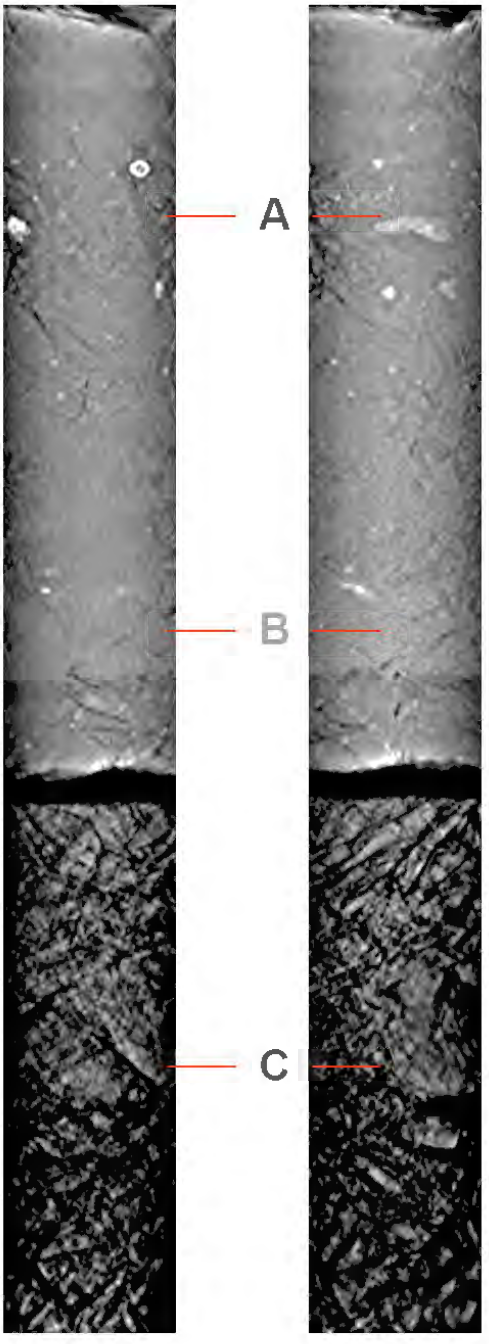



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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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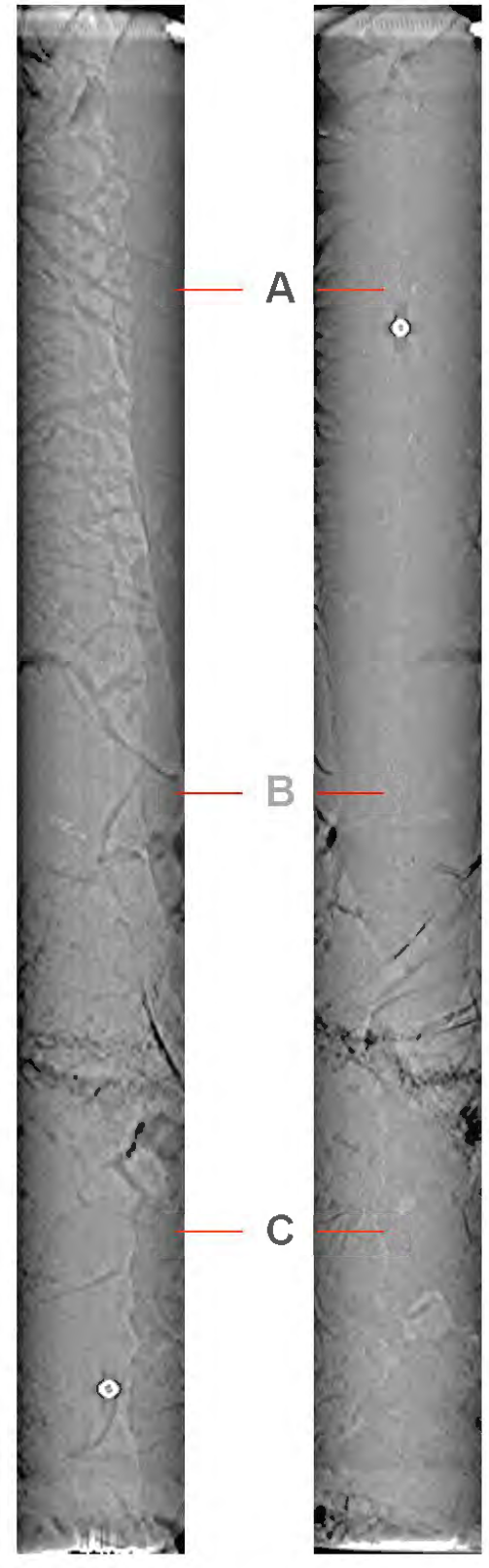

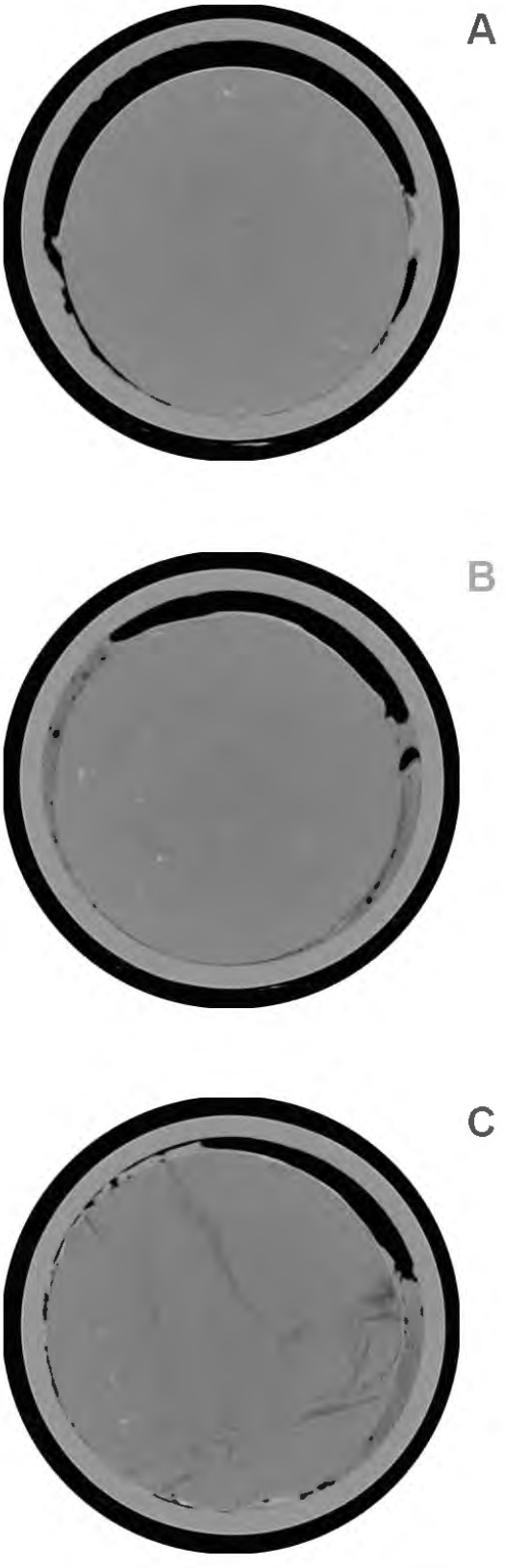

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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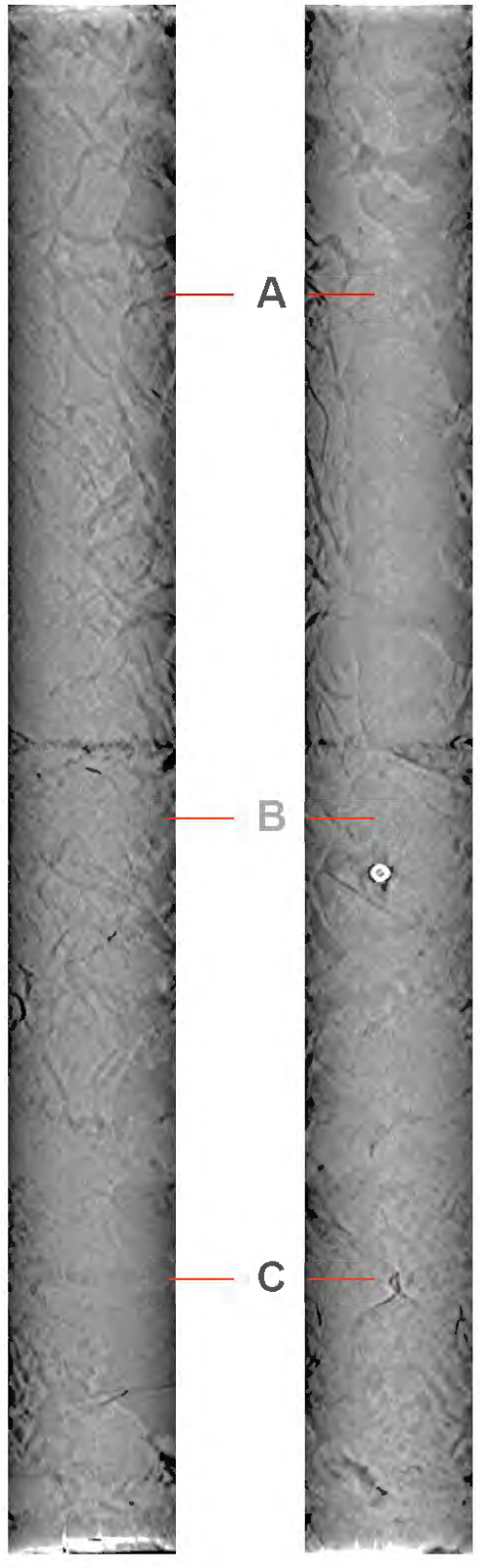



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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

0°	90°	Axials

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Depth (ft)

TENTHS

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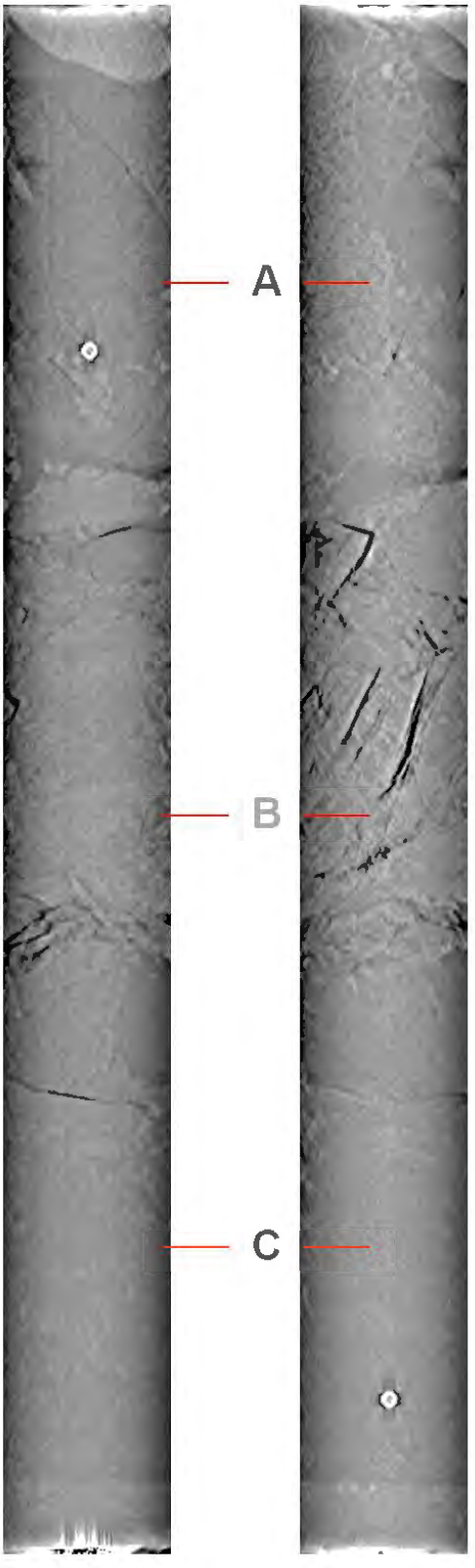



UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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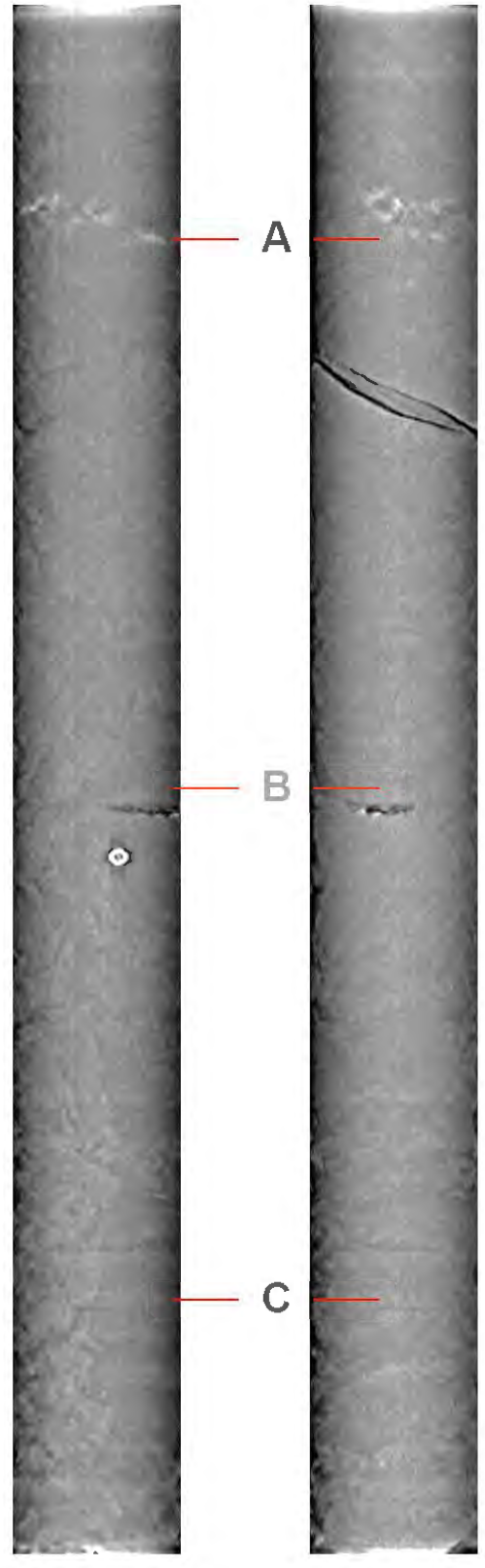



UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

0°	90°	Axials

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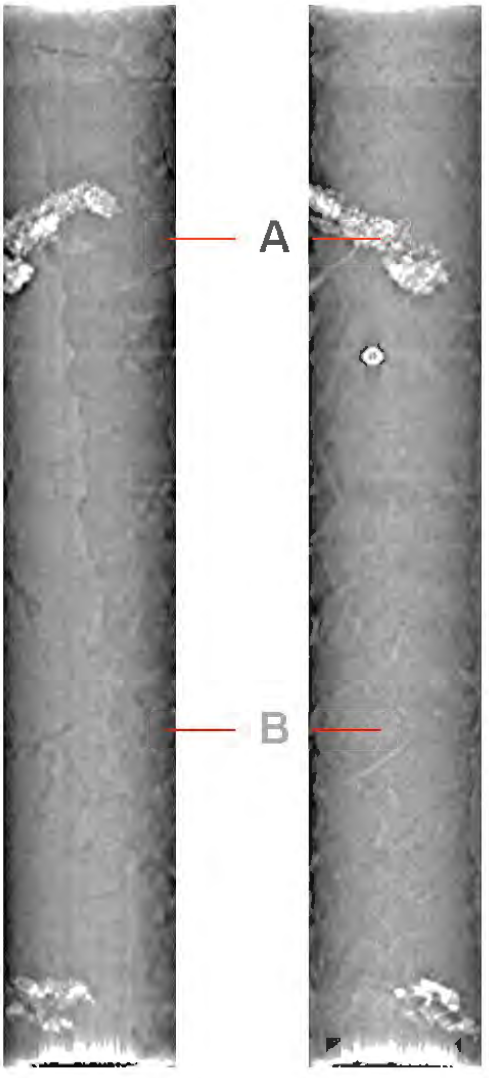
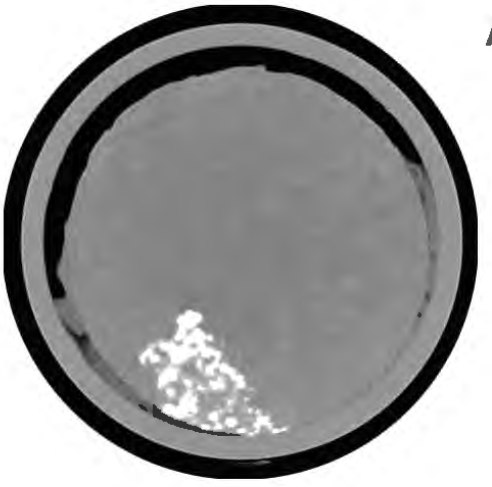
Depth (ft)

TENTHS







UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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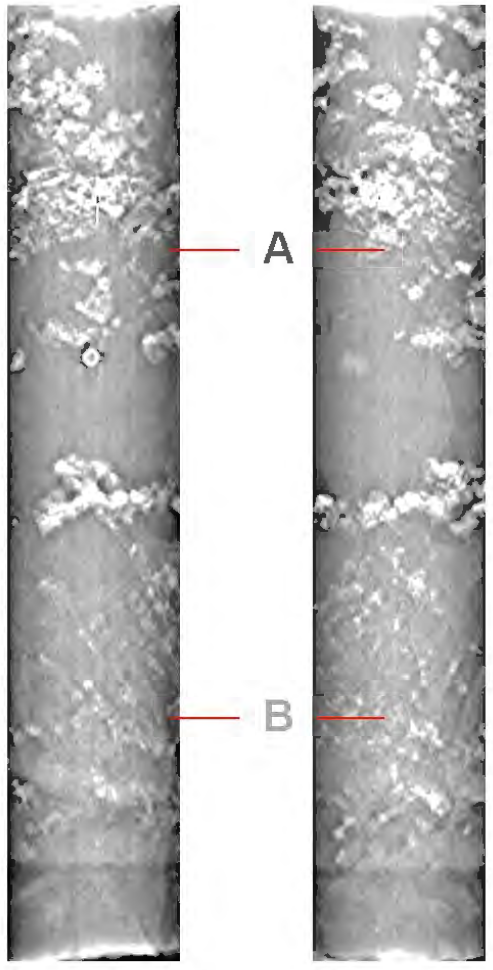
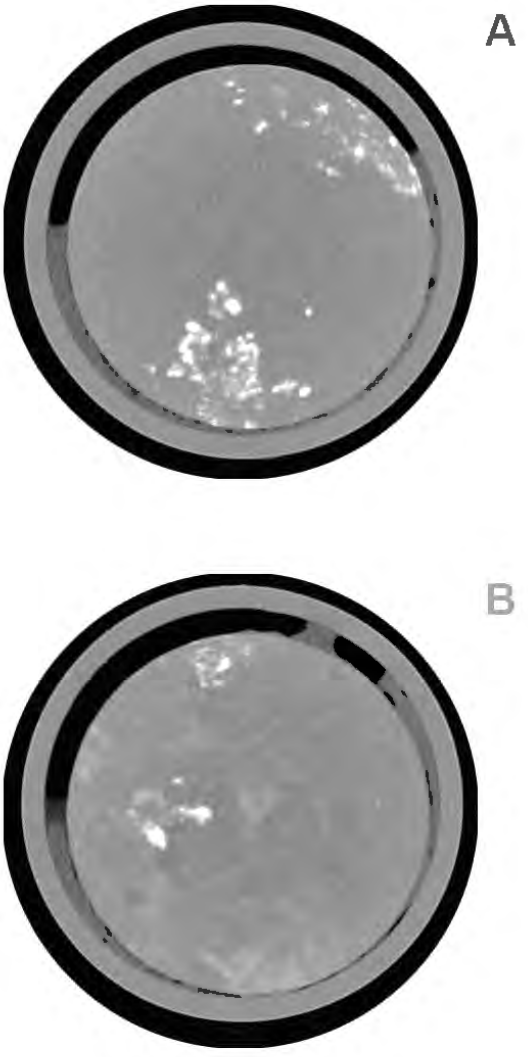




Pacific Gas and Electric Company

Piacentine 2-27

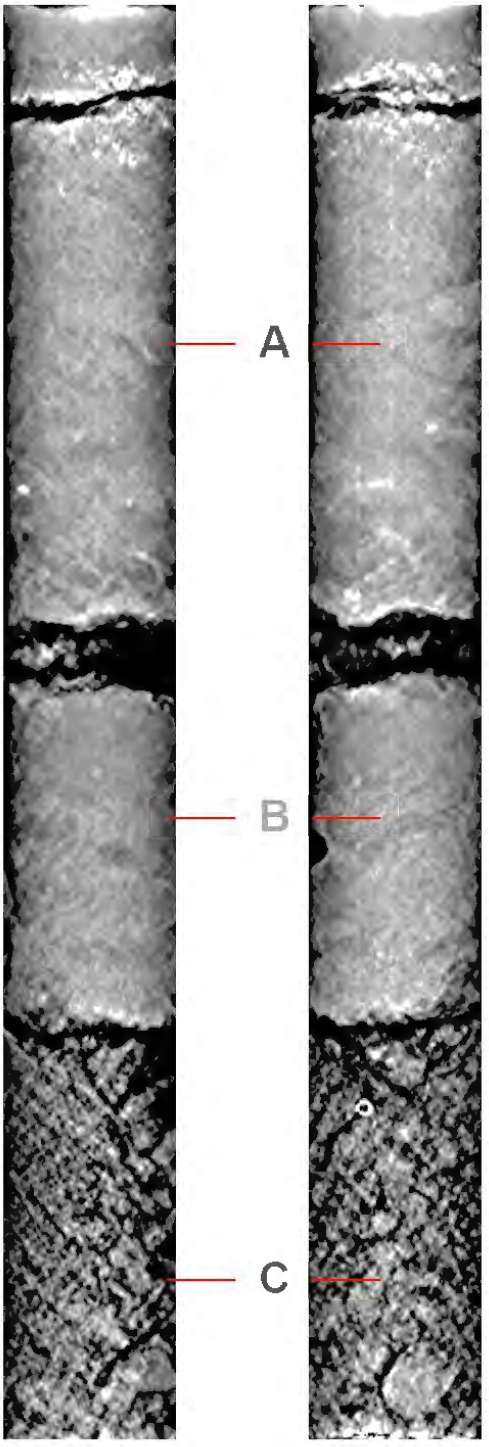
File No.: 113011PG

0°	90°	Axials

4681.80

Depth (ft)

TENTHS





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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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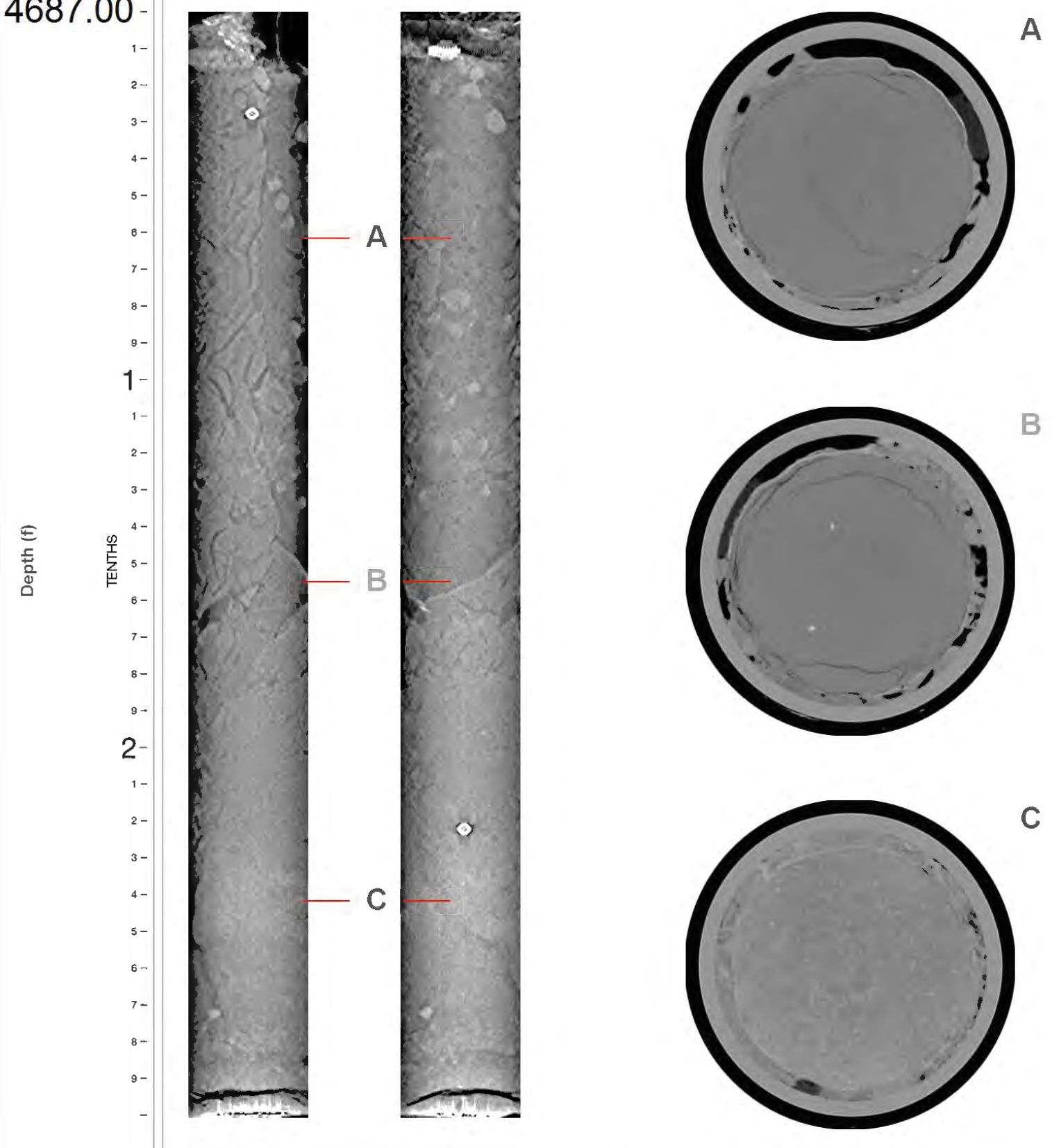

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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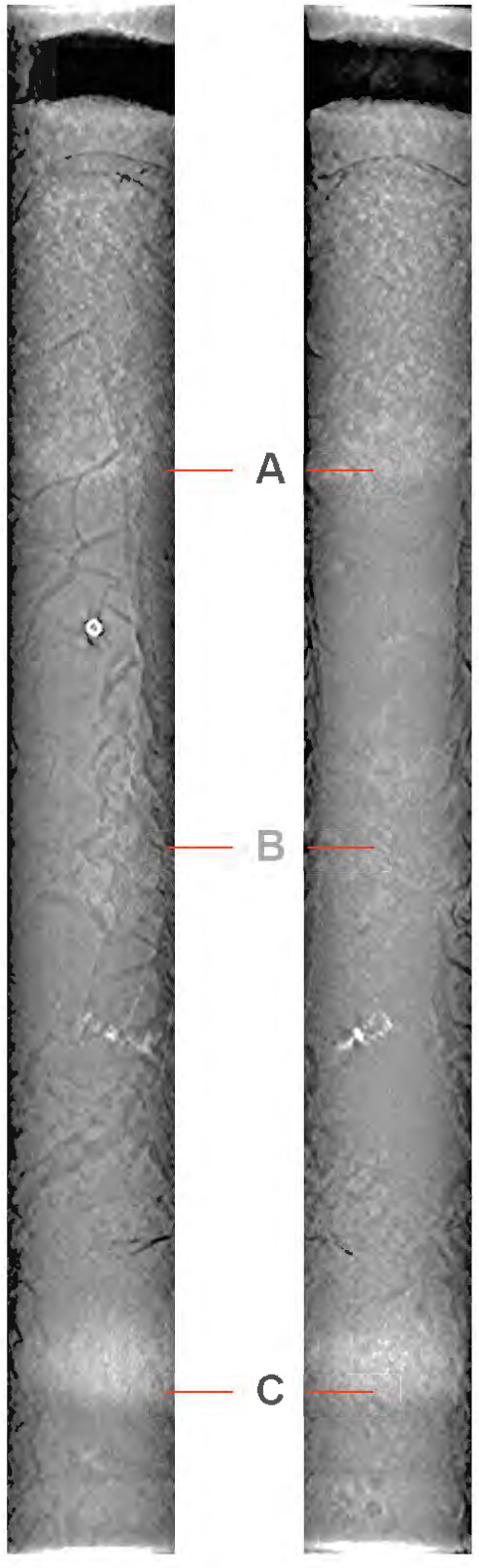

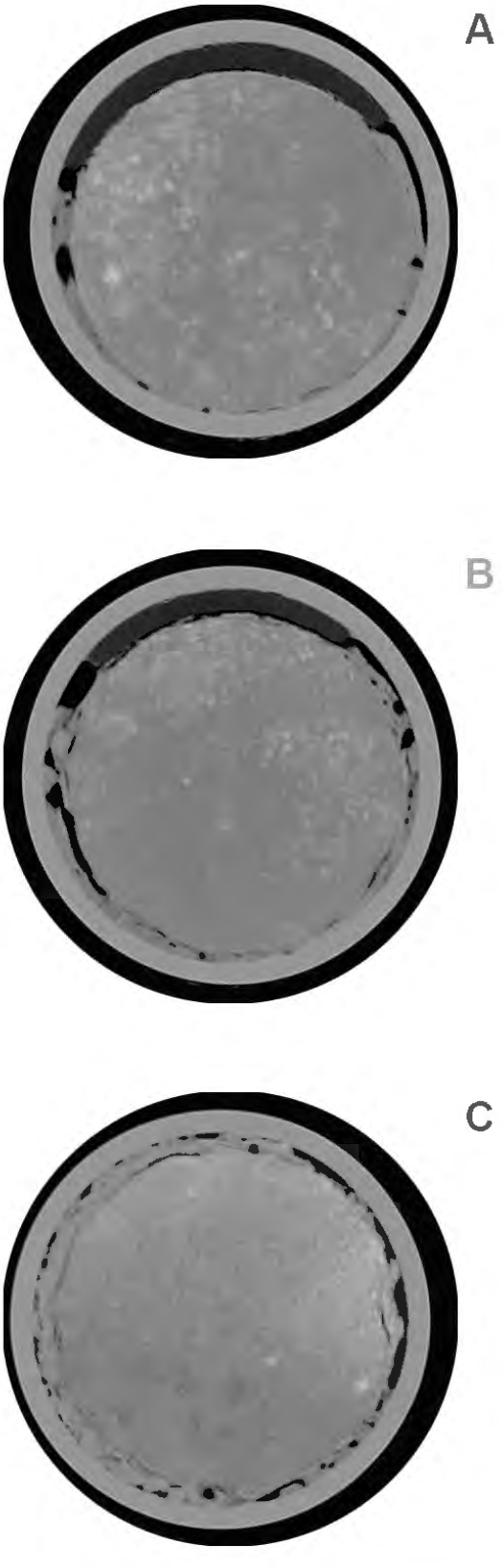

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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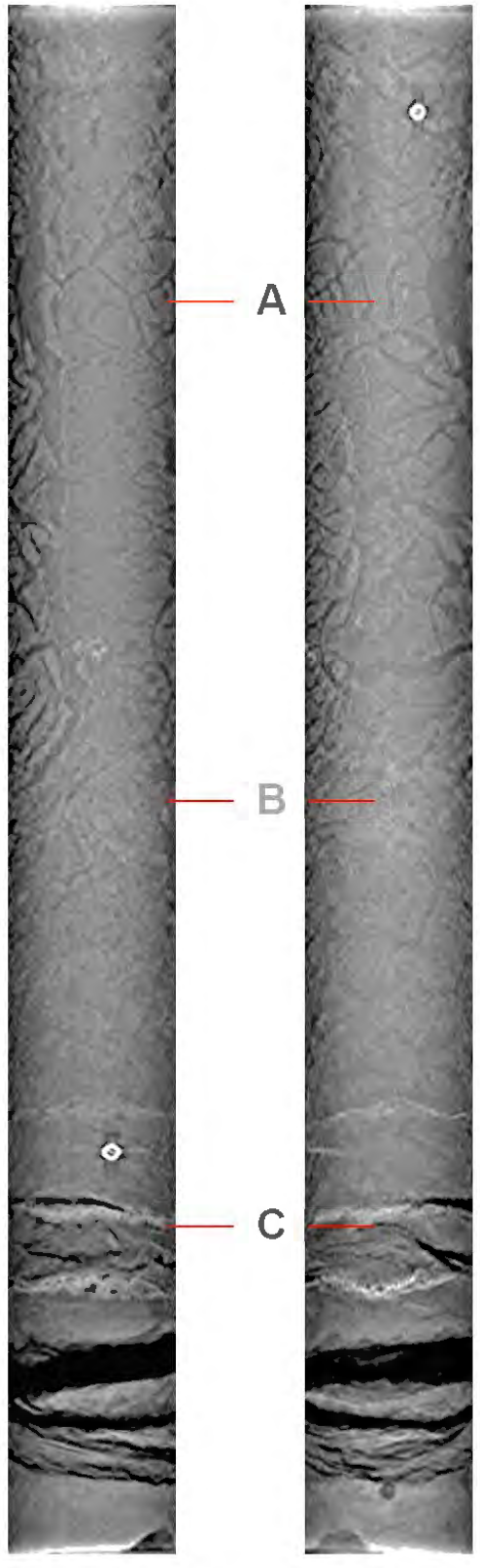

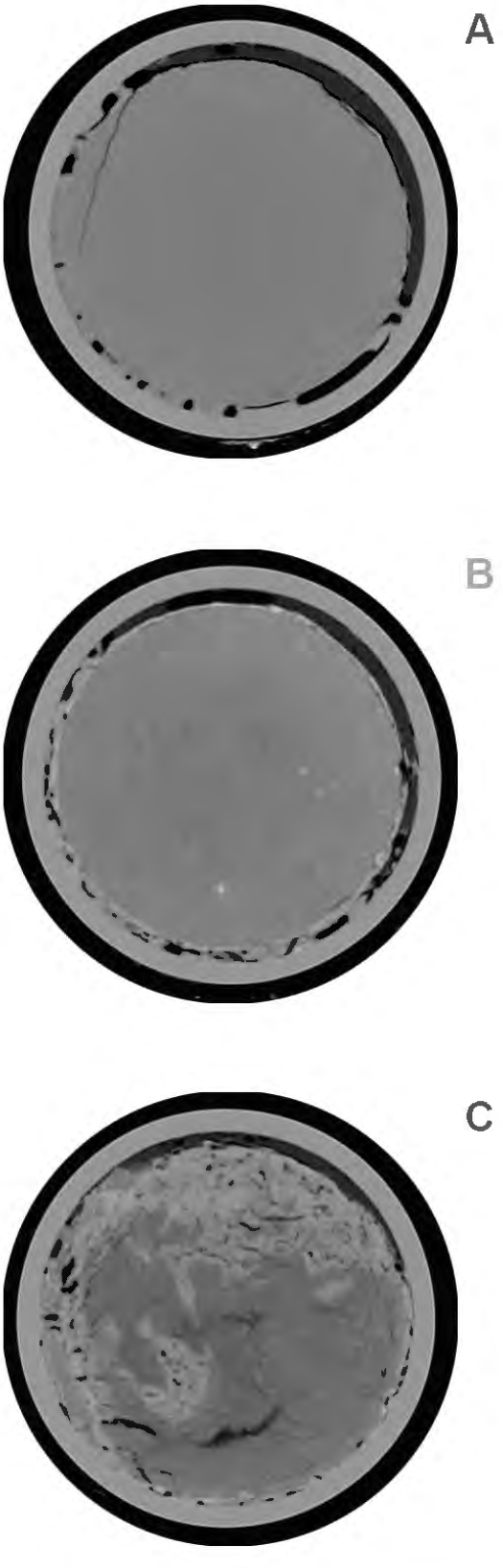

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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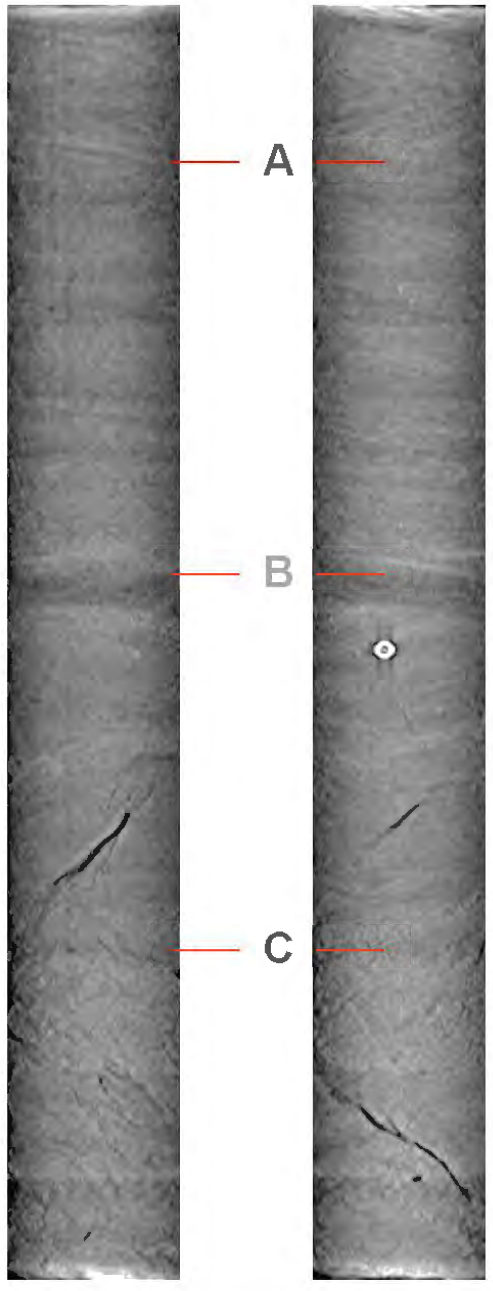
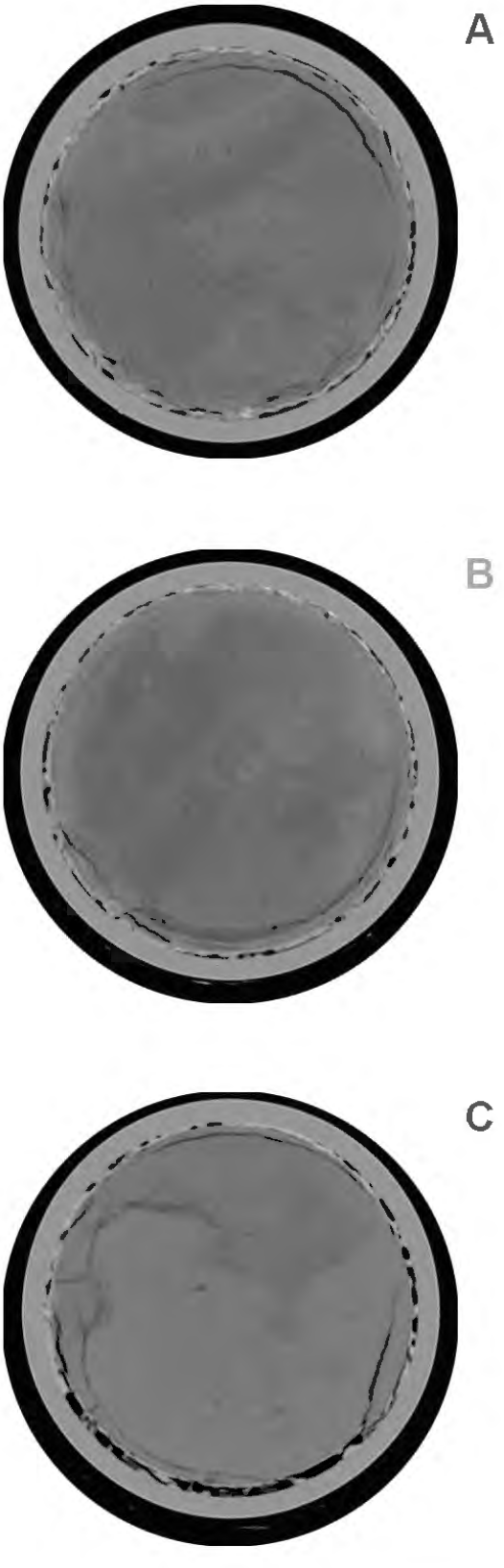




UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

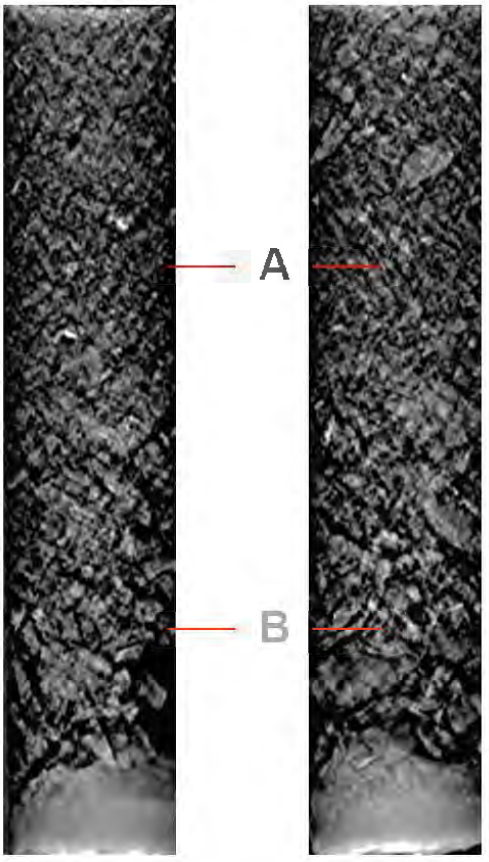
File No.: 113011PG

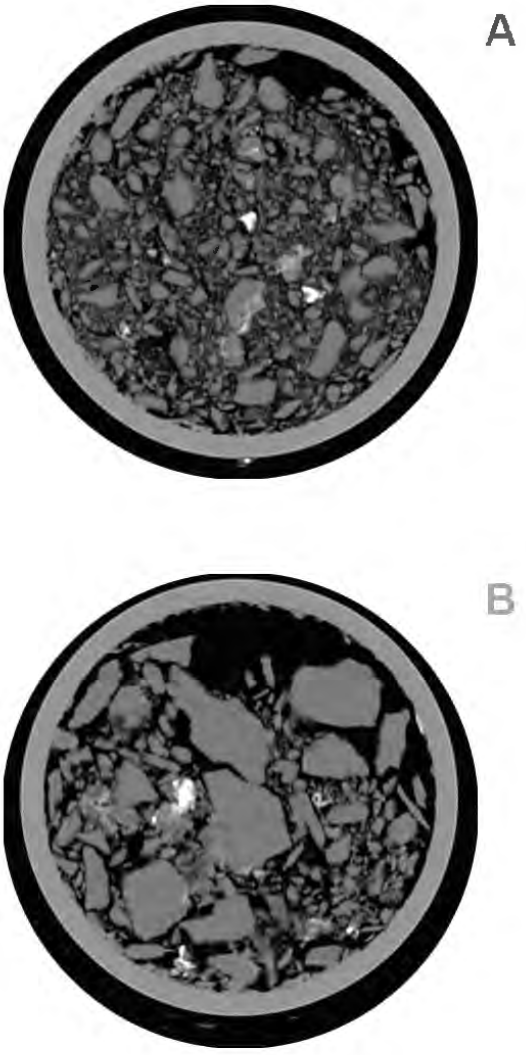
0°	90°	Axials

4698.40

Depth (ft)

TENTHS





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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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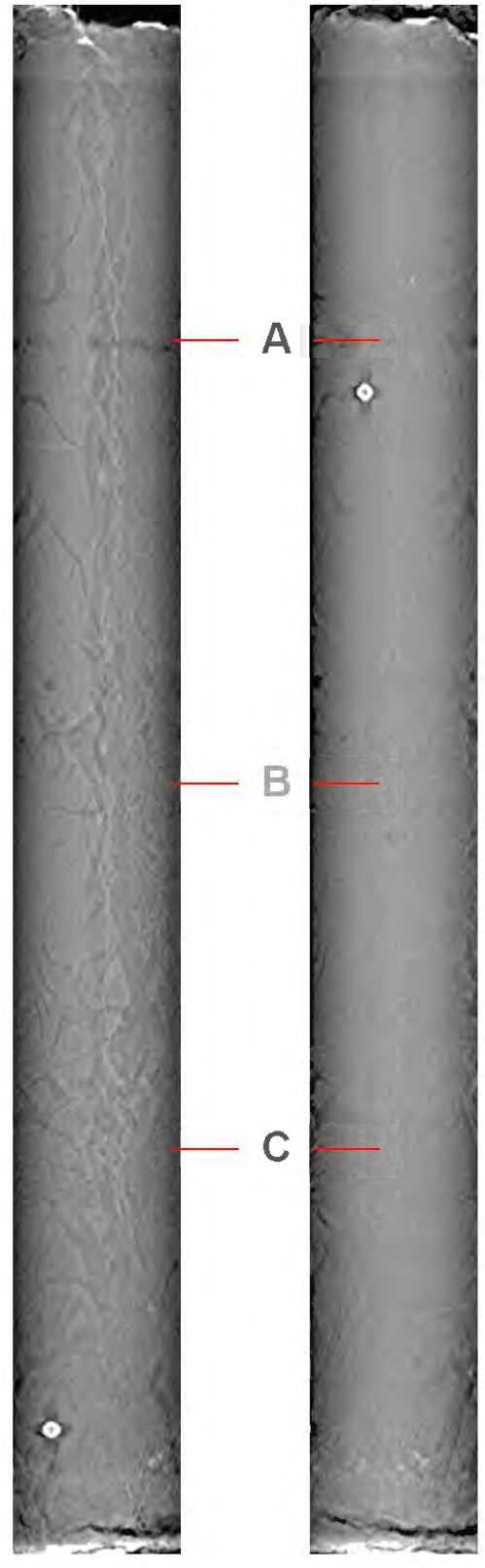

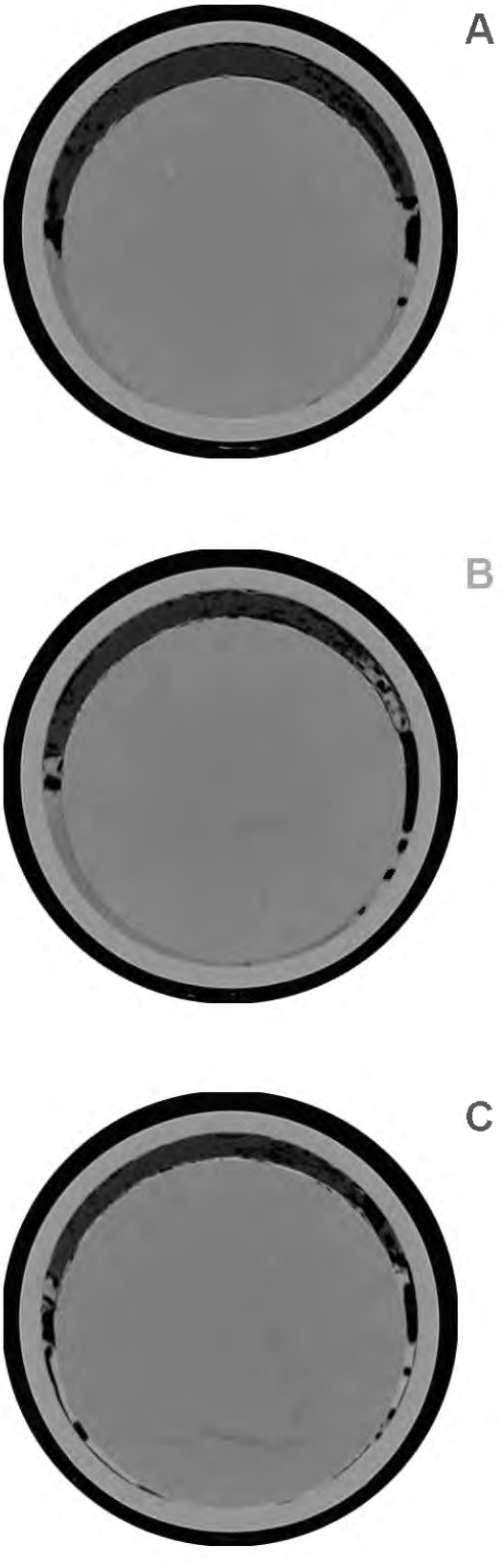

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Pacific Gas and Electric Company

Piacentine 2-27

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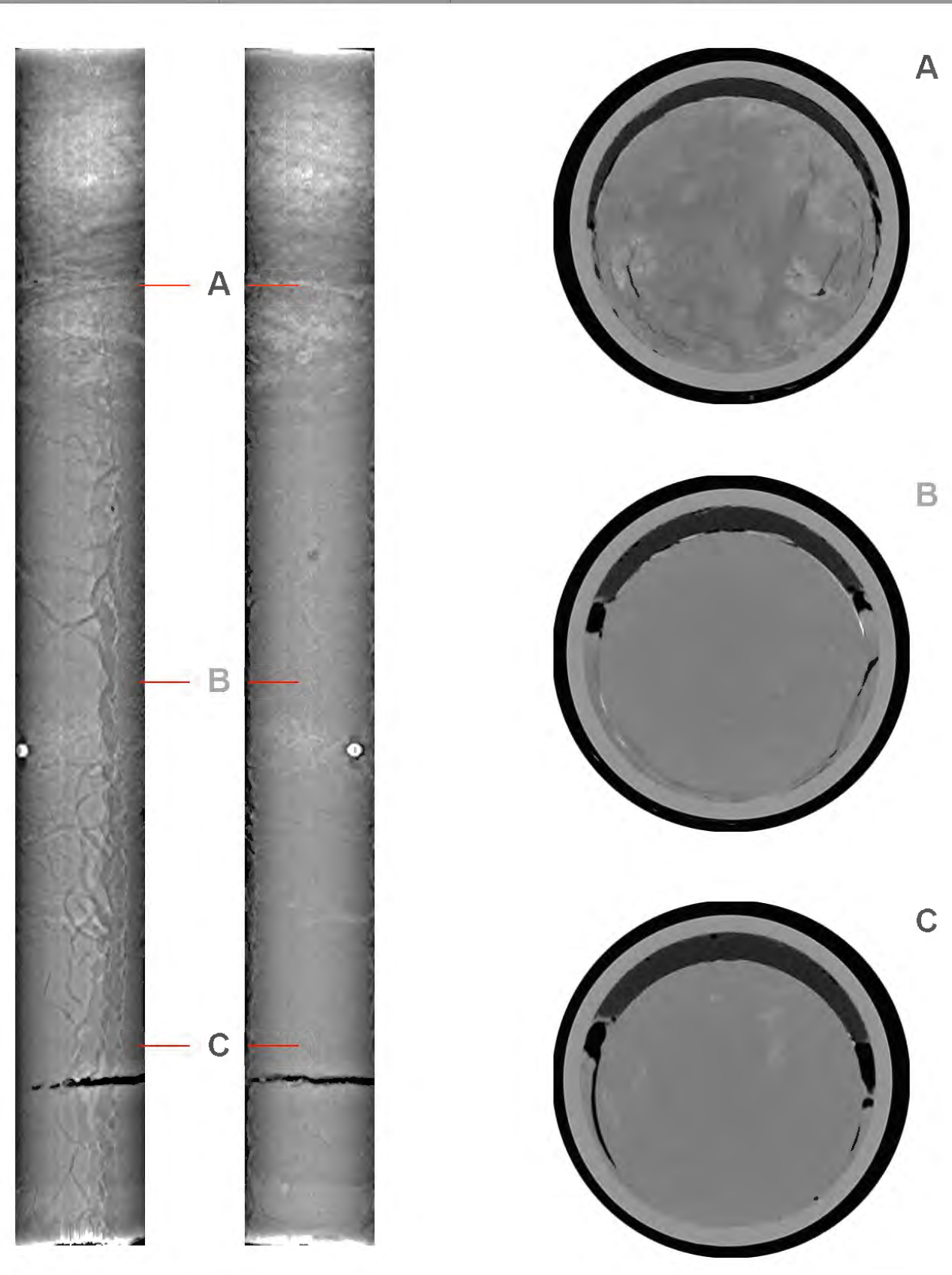

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Pacific Gas and Electric Company

Piacentine 2-27

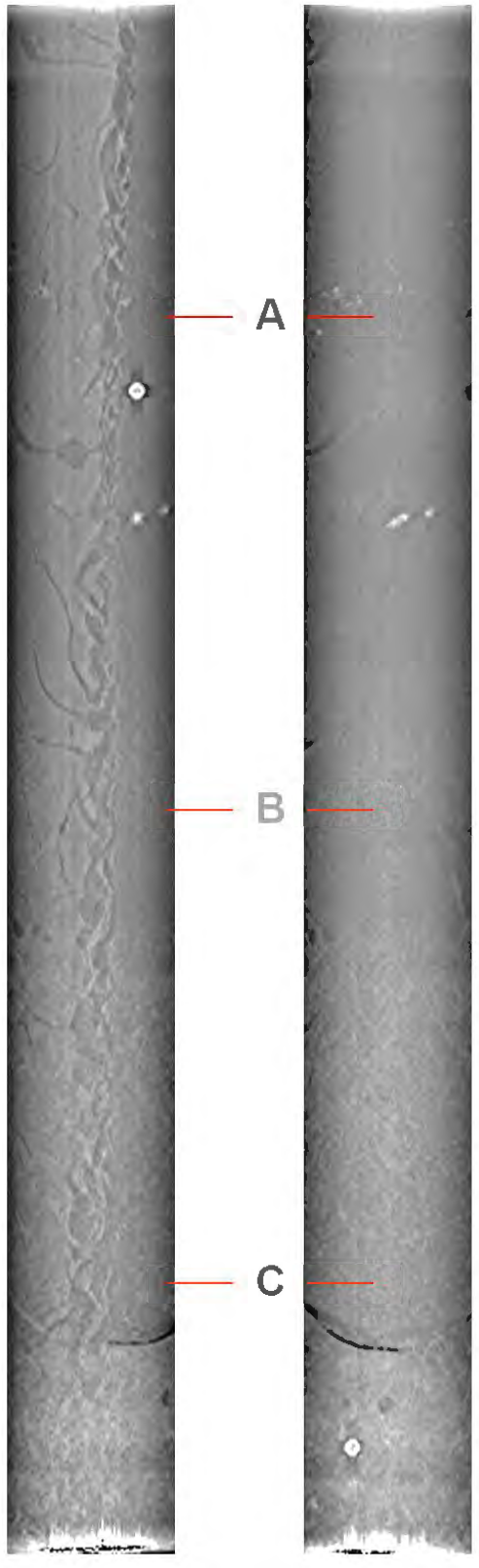
File No.: 113011PG

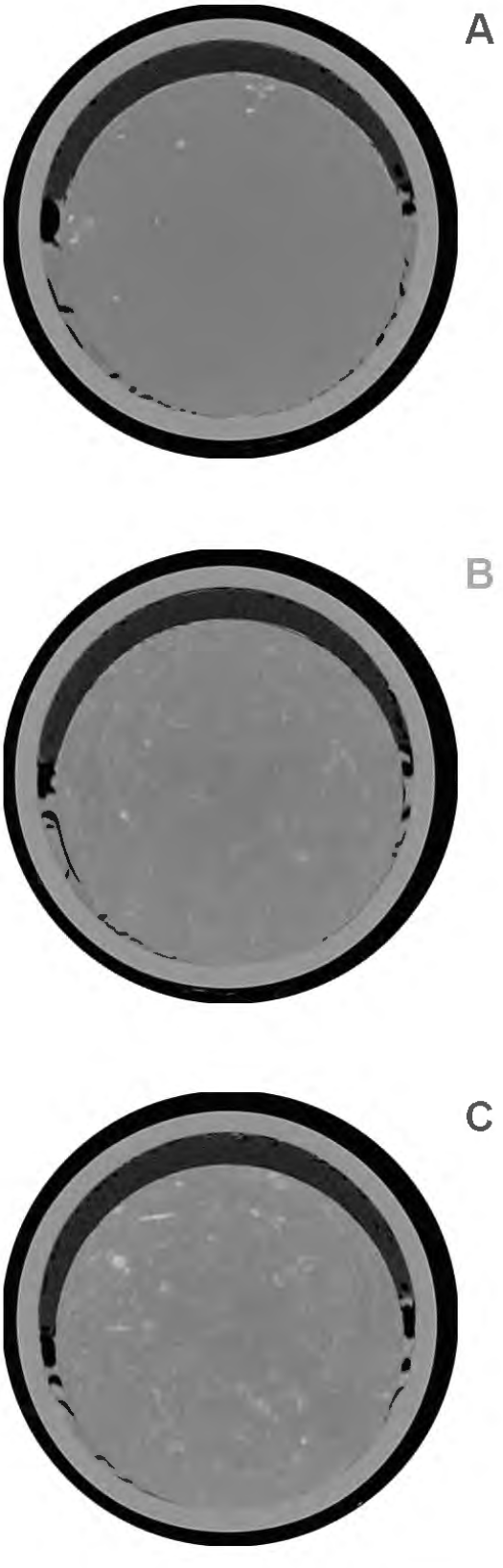
0°	90°	Axials

4707.00

Depth (f)

TENTHS





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Pacific Gas and Electric Company

Piacentine 2-27

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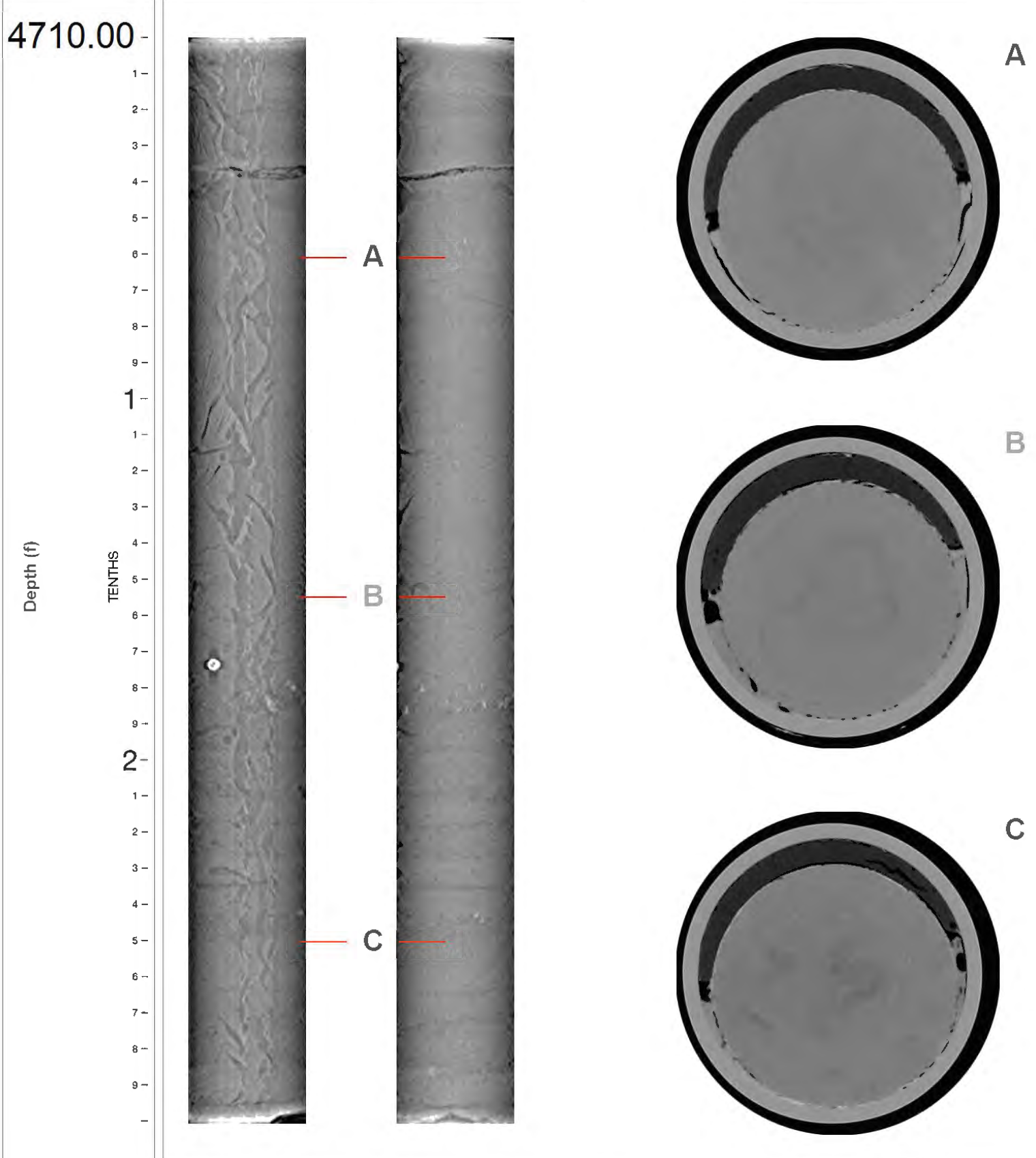
0°	90°	Axials



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Pacific Gas and Electric Company

Piacentine 2-27

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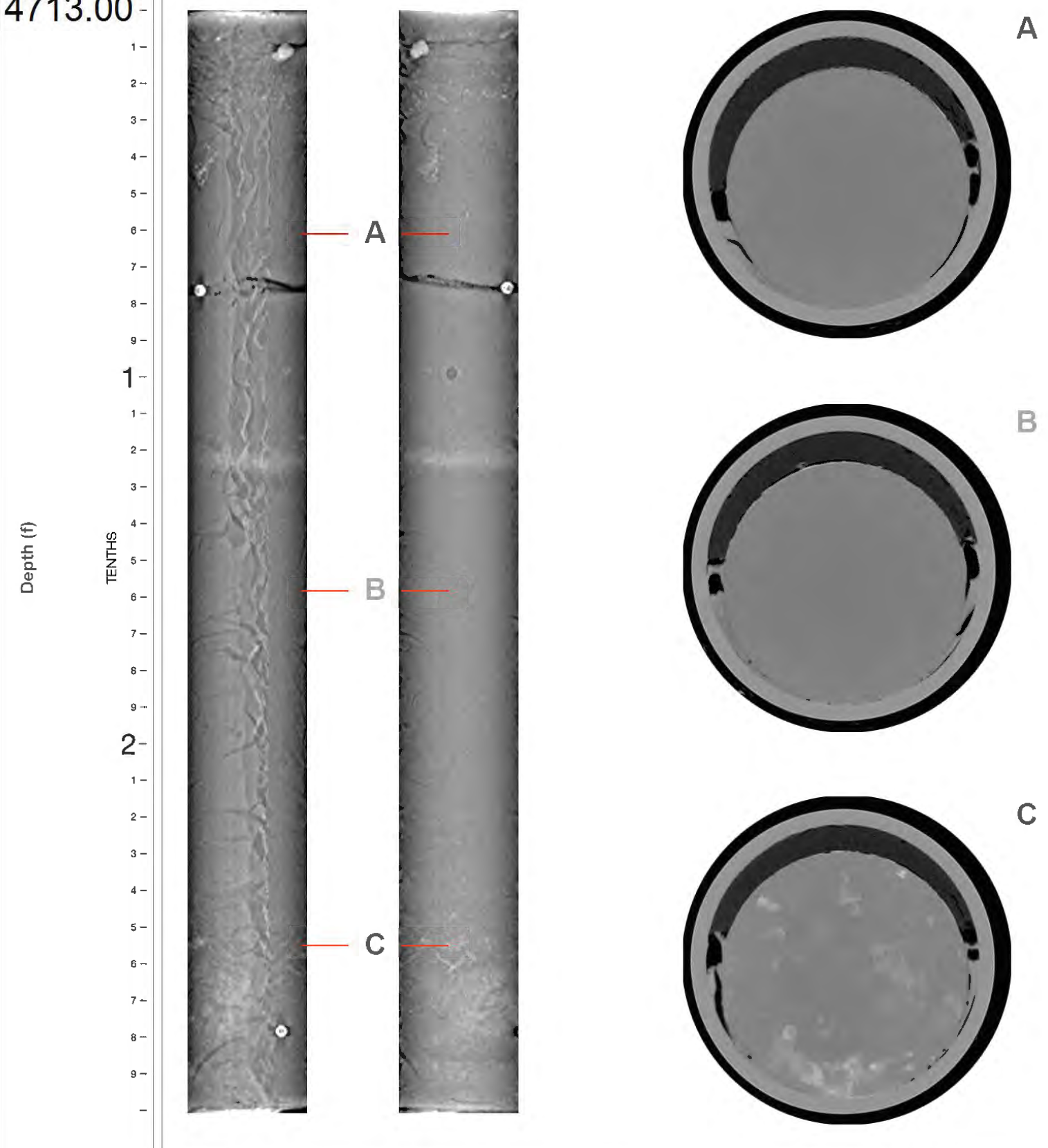

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Pacific Gas and Electric Company

Piacentine 2-27

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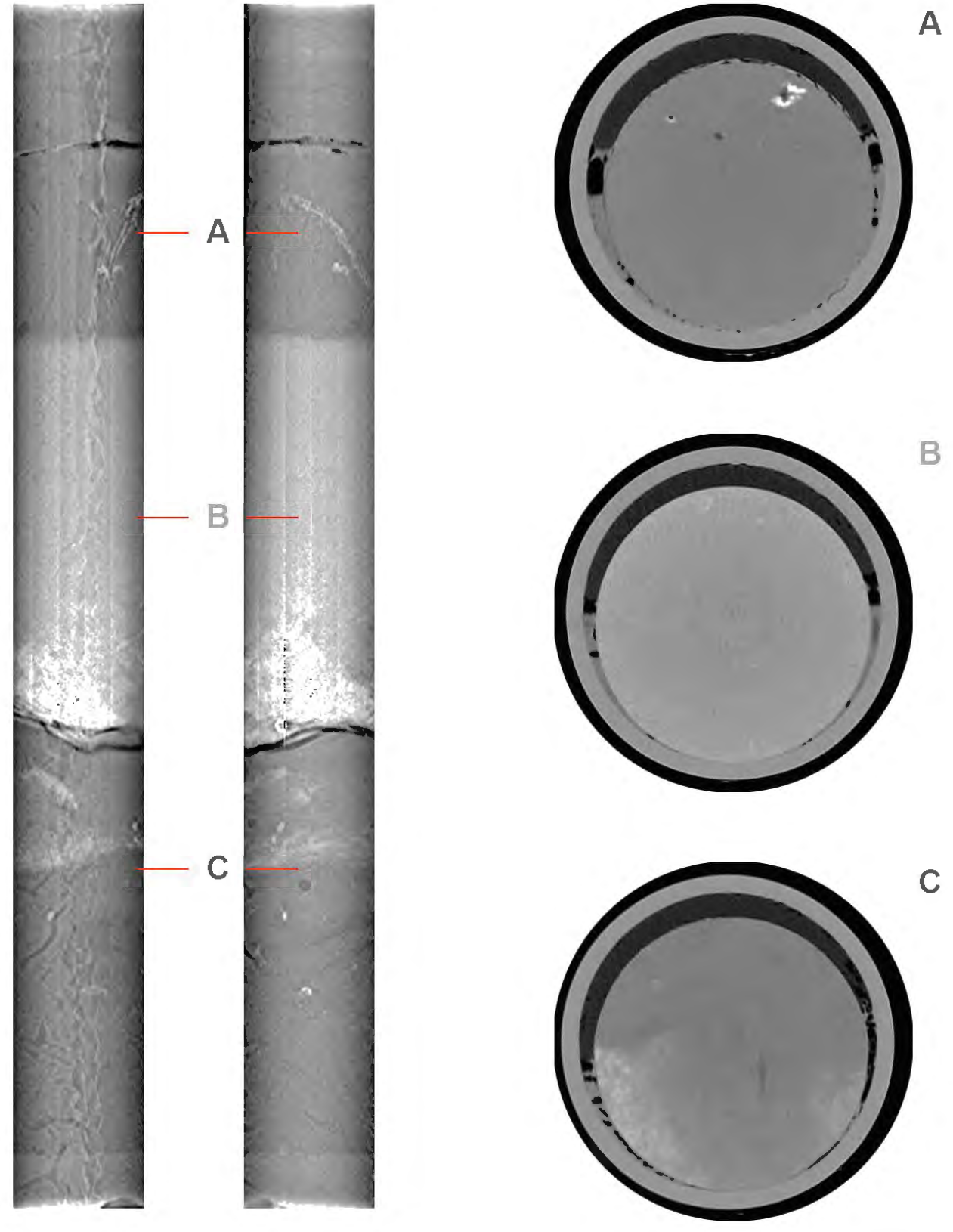

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Pacific Gas and Electric Company

Piacentine 2-27

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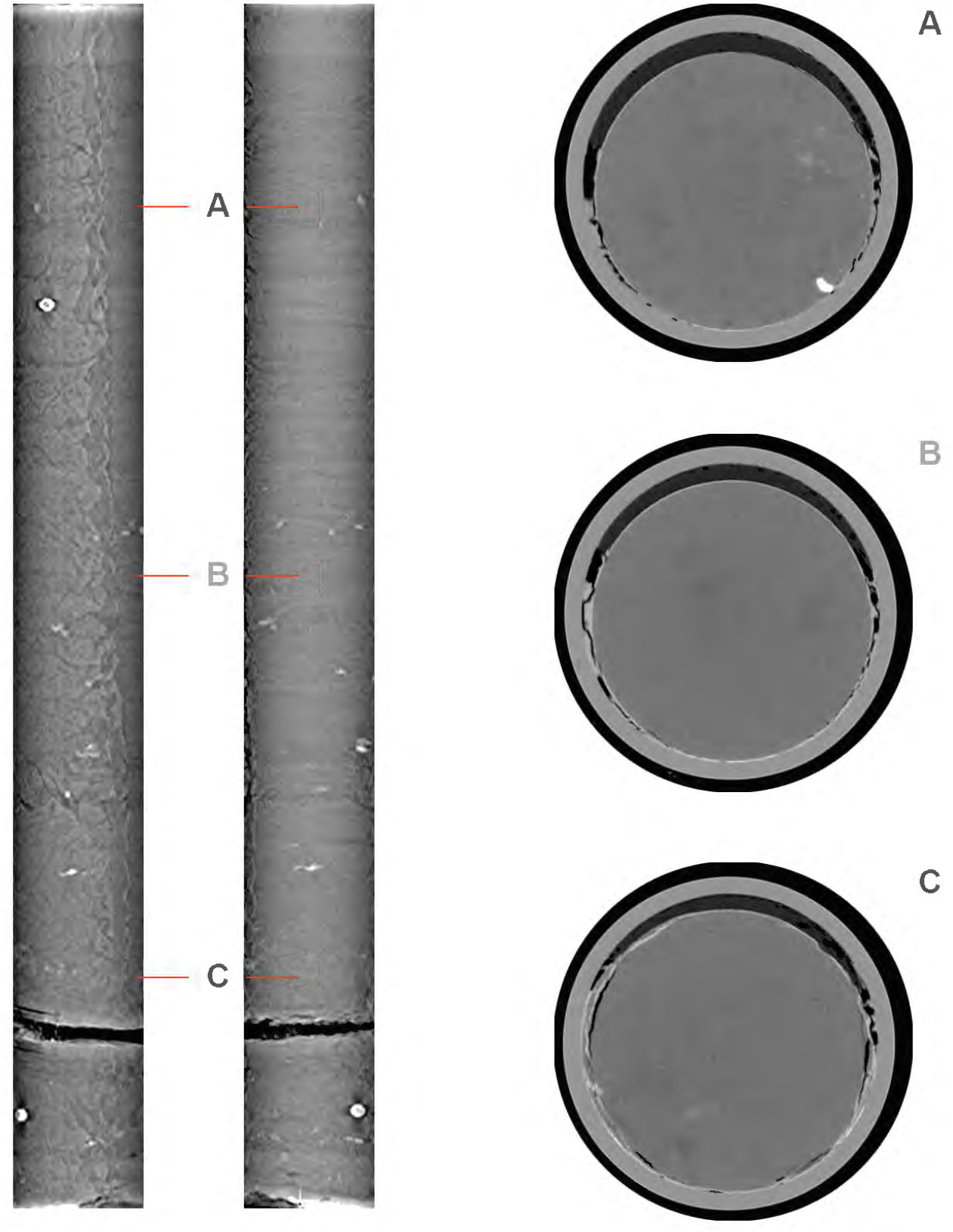

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Pacific Gas and Electric Company

Piacentine 2-27

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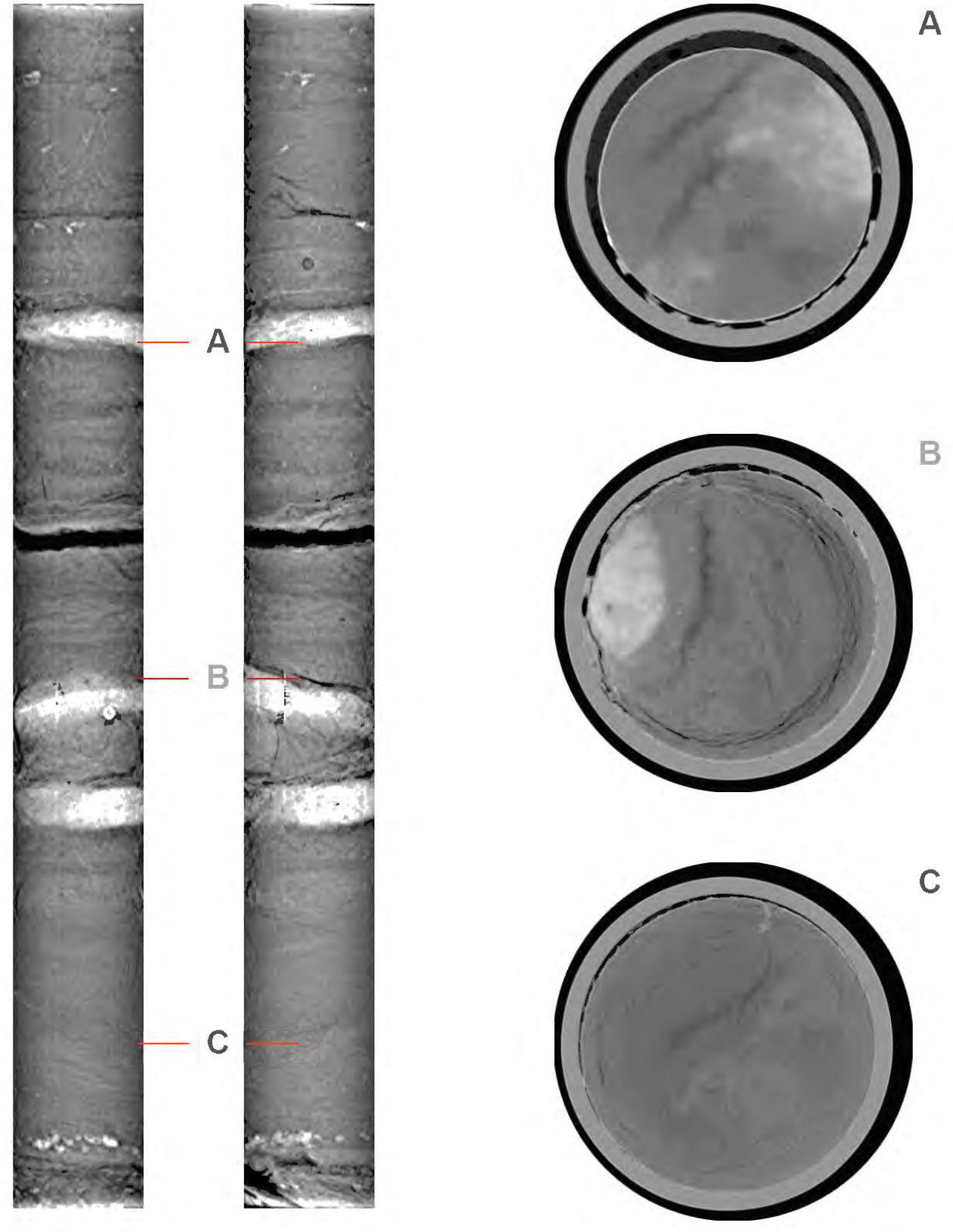

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Pacific Gas and Electric Company

Piacentine 2-27

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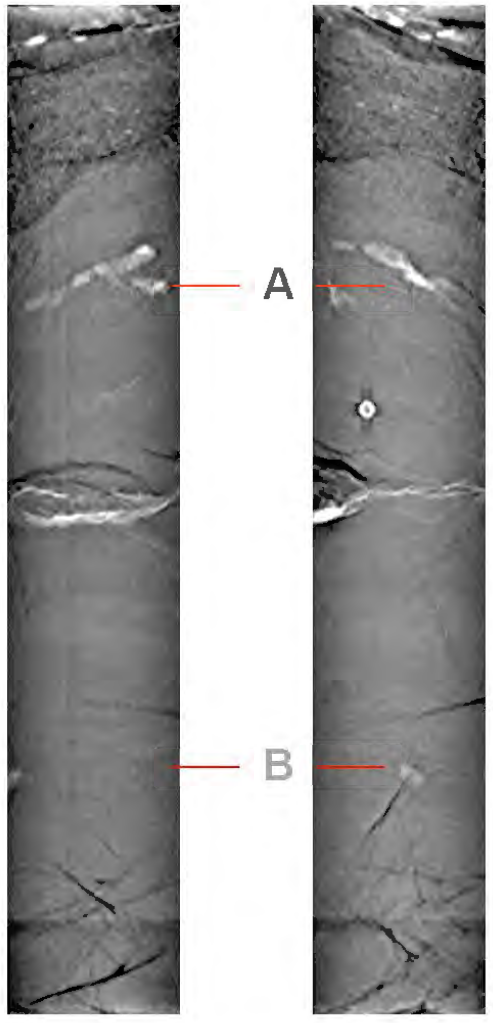
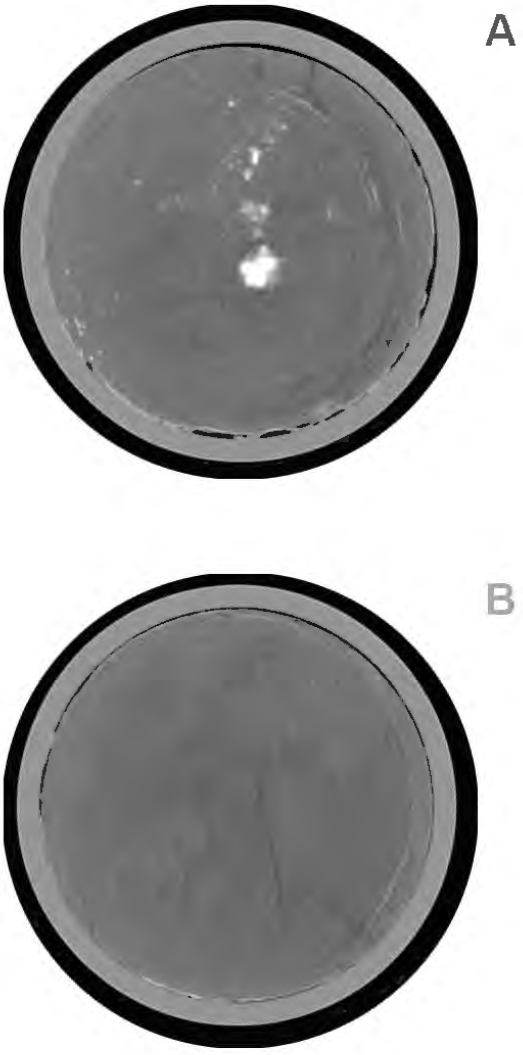




Depth (f)

4725.00

TENTHS

Pacific Gas and Electric Company

Piacentine 2-27

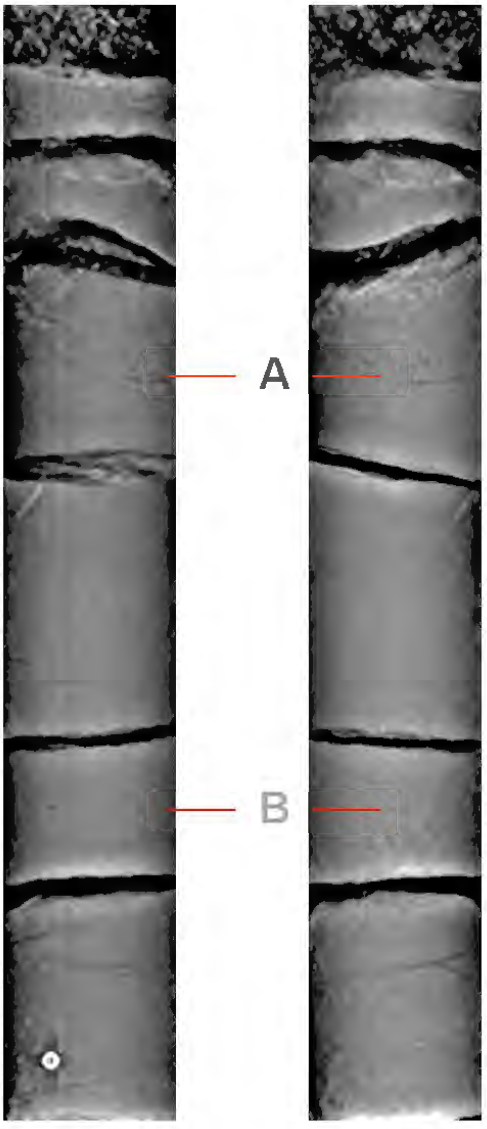
File No.: 113011PG

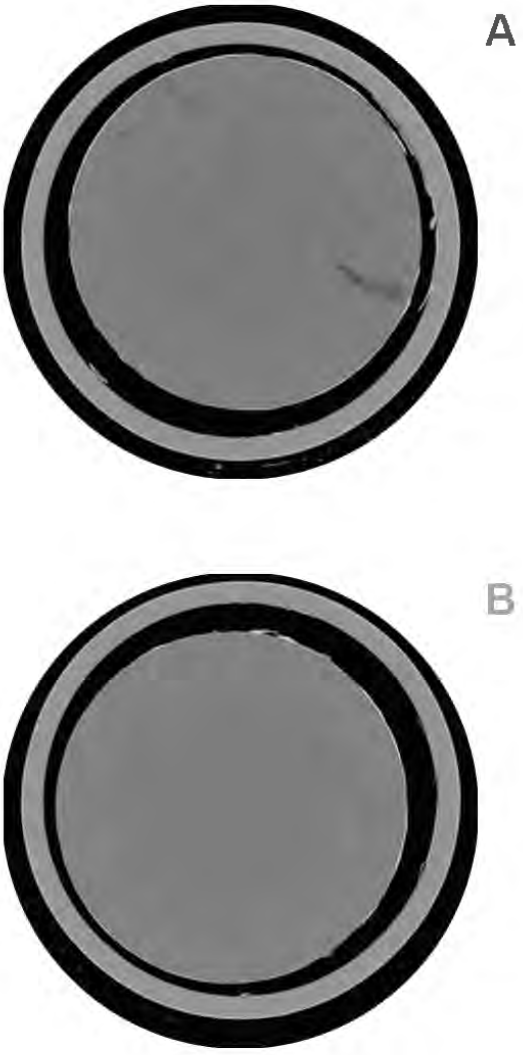
0°	90°	Axials

4726.90

Depth (ft)

TENTHS





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Pacific Gas and Electric Company

Piacentine 2-27

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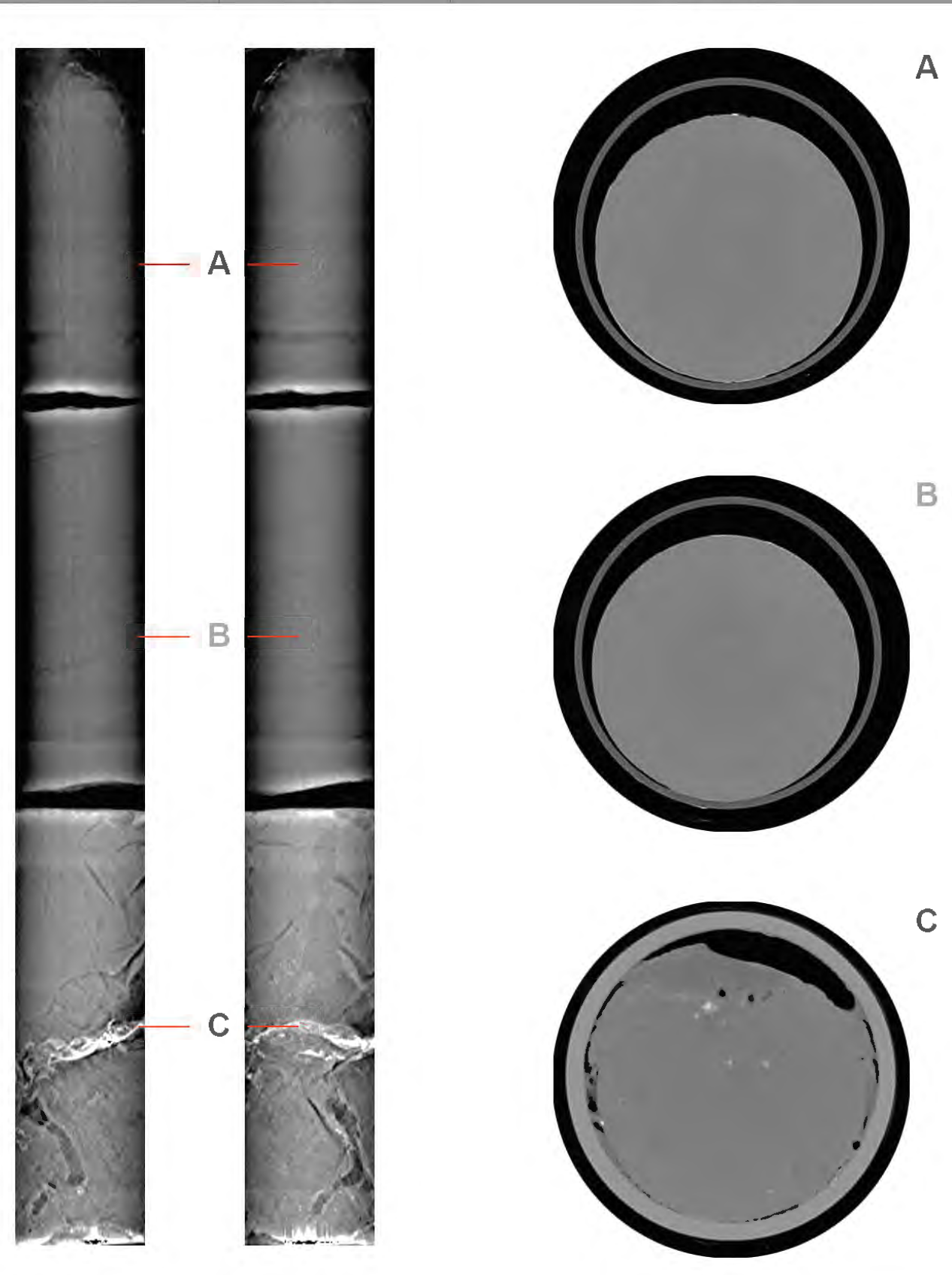


UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

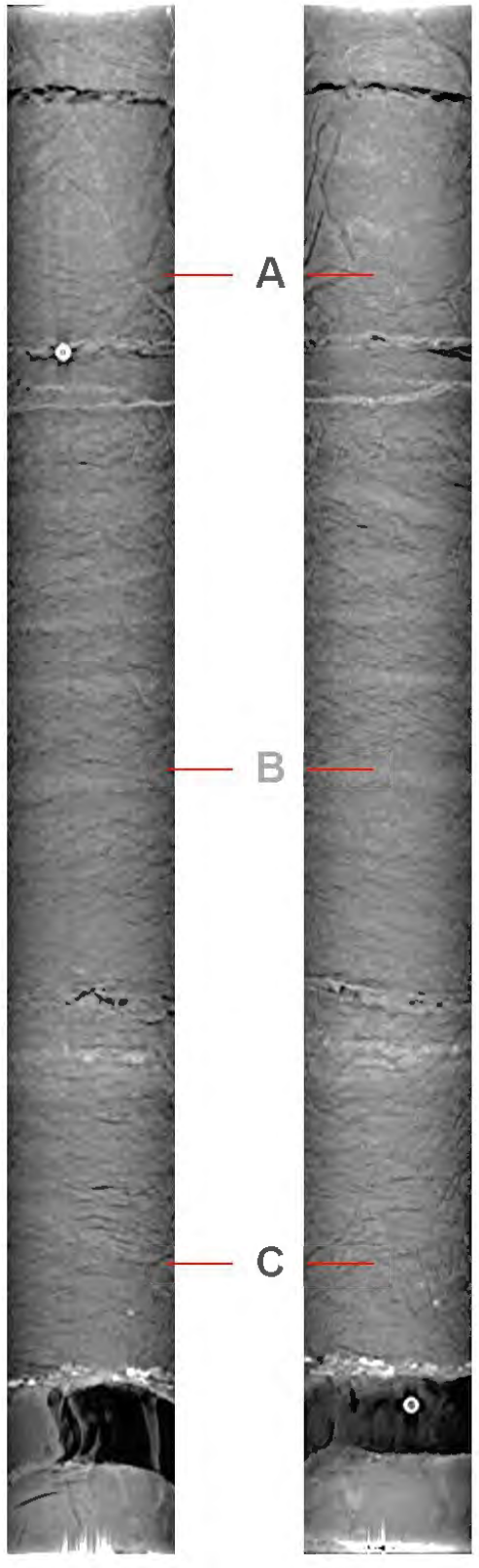
File No.: 113011PG

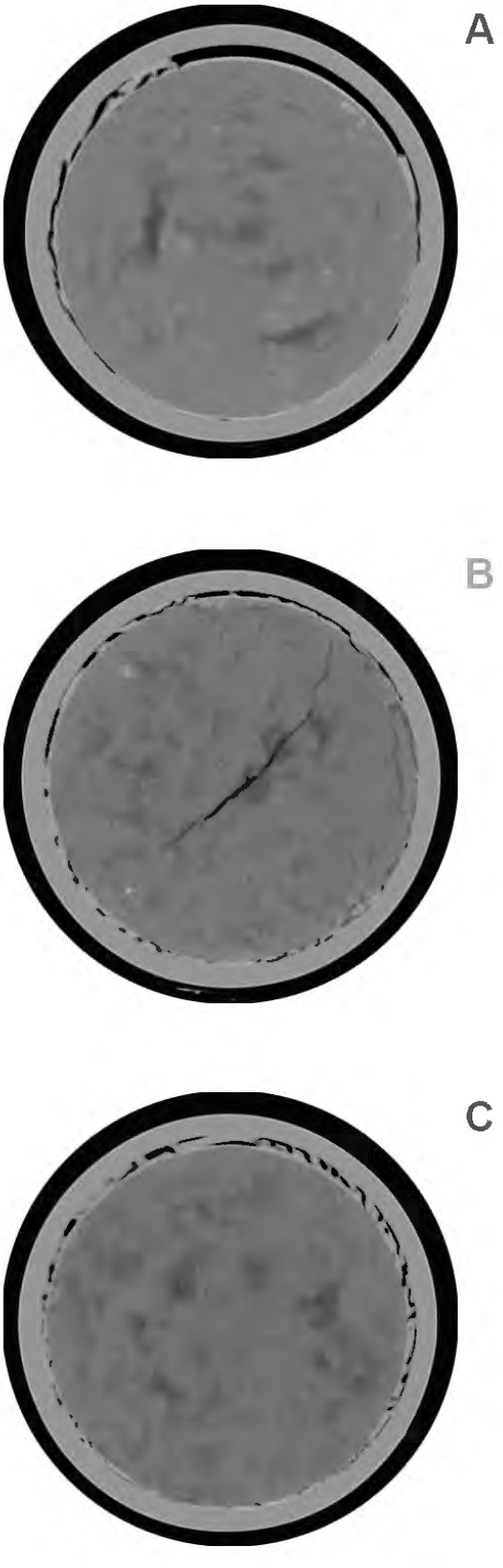
0°	90°	Axials

4732.00

Depth (f)

TENTHS





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Pacific Gas and Electric Company

Piacentine 2-27

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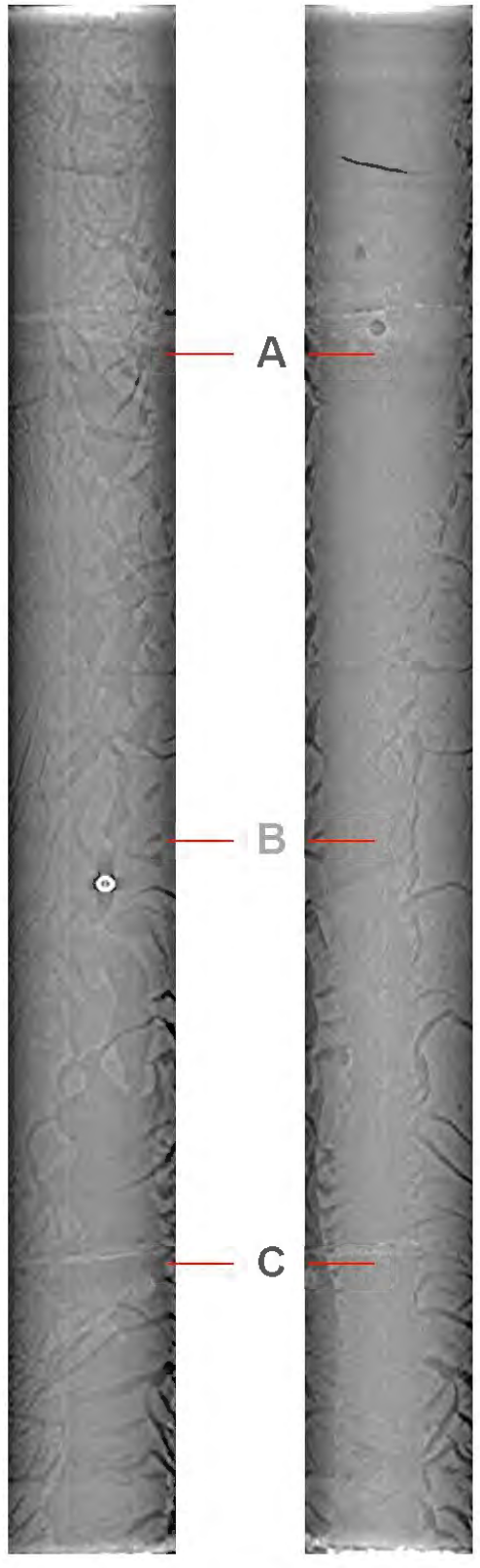

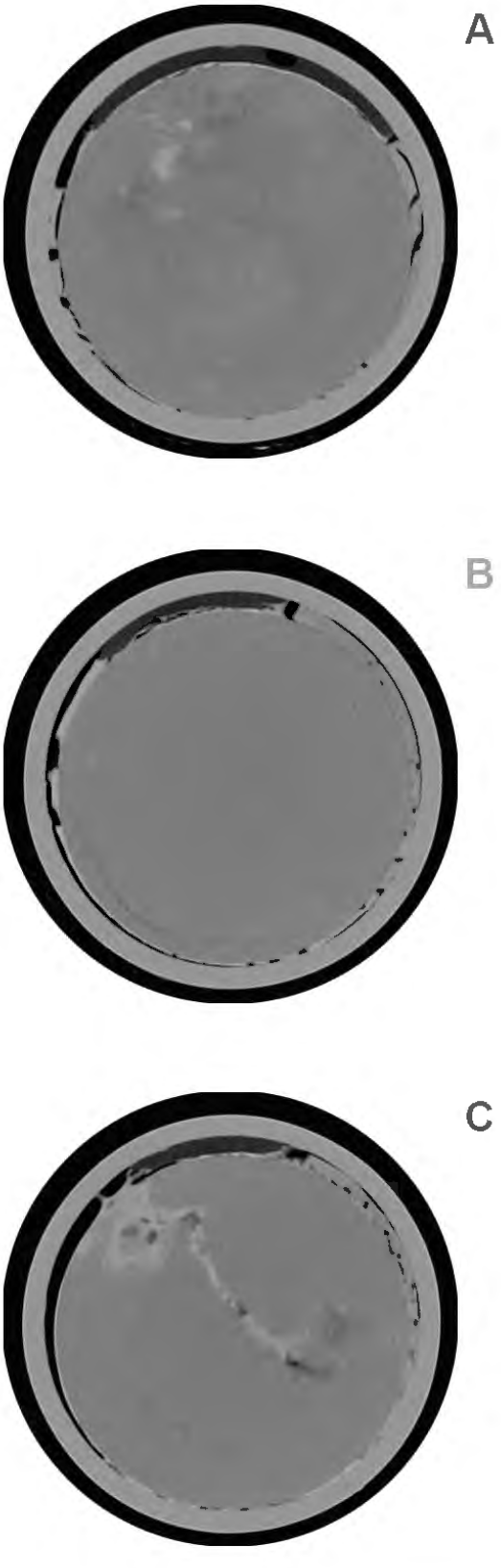

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

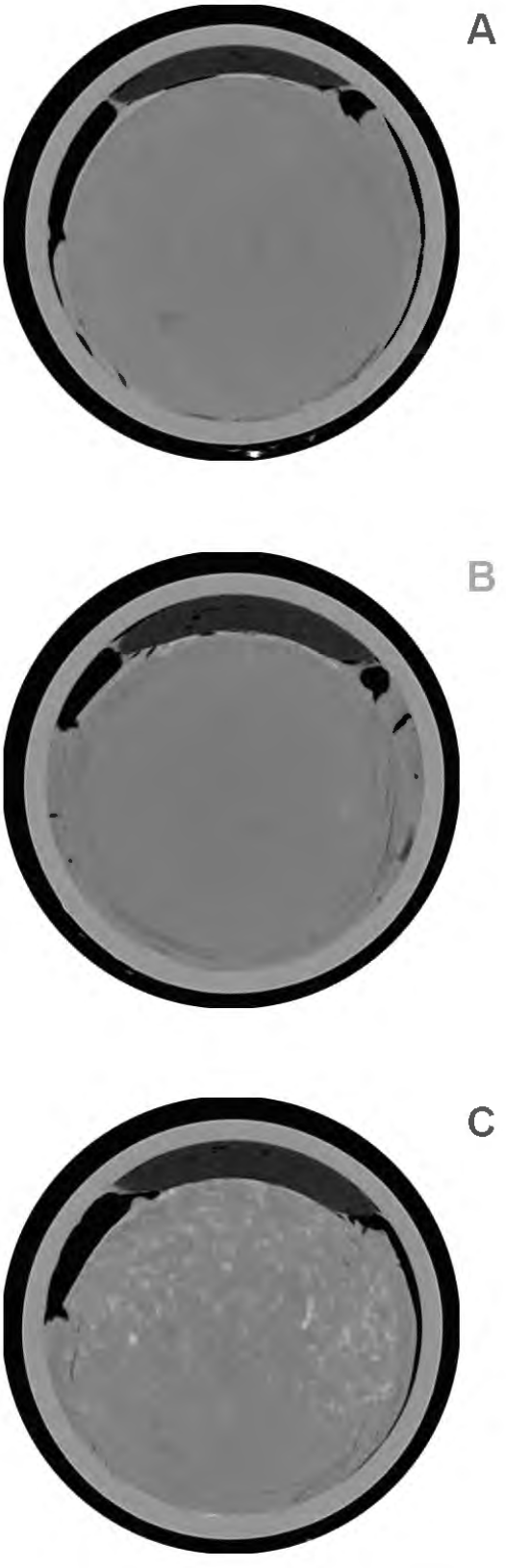
0°	90°	Axials

4738.00

Depth (f)

TENTHS





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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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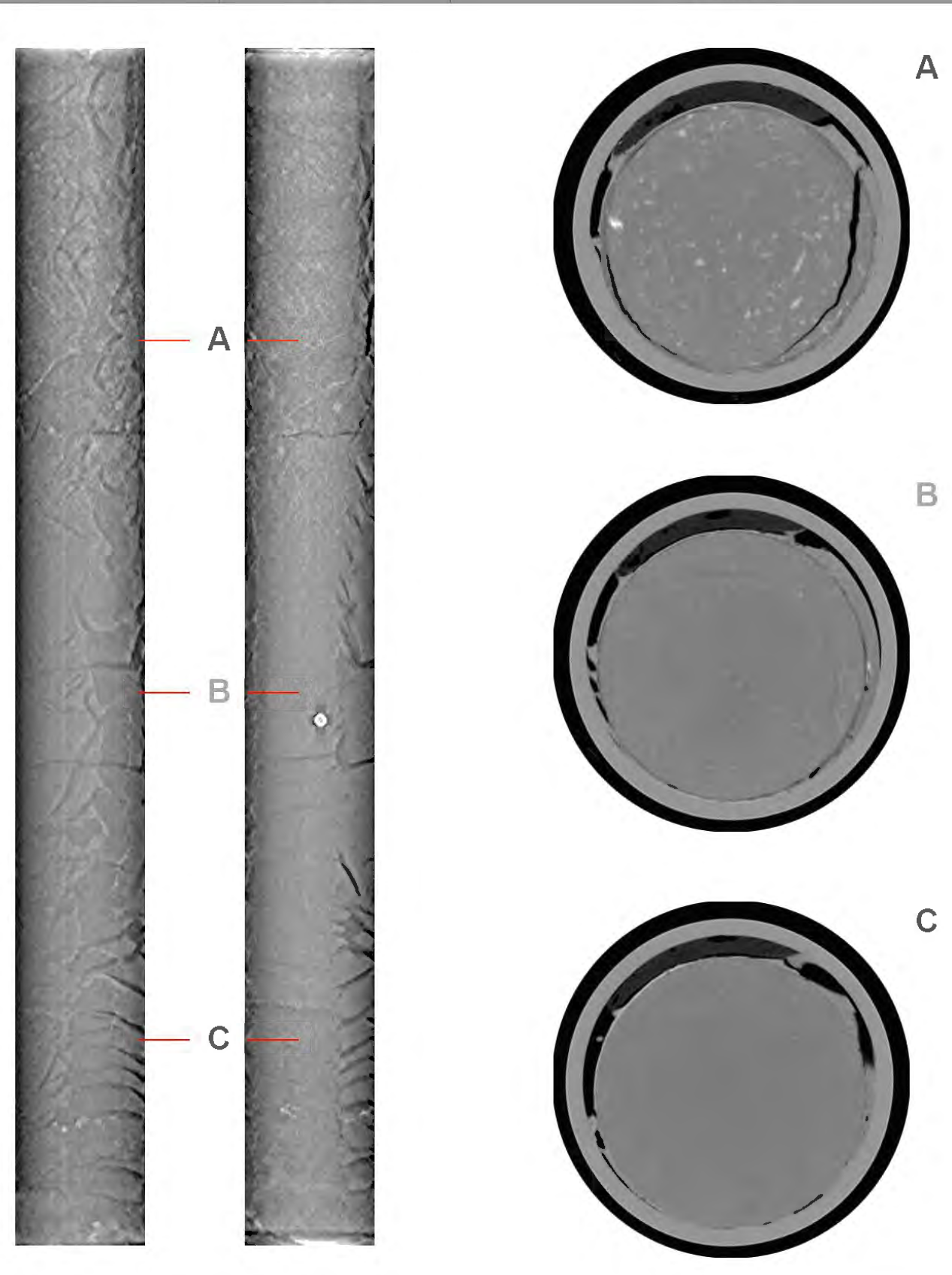

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Pacific Gas and Electric Company

Piacentine 2-27

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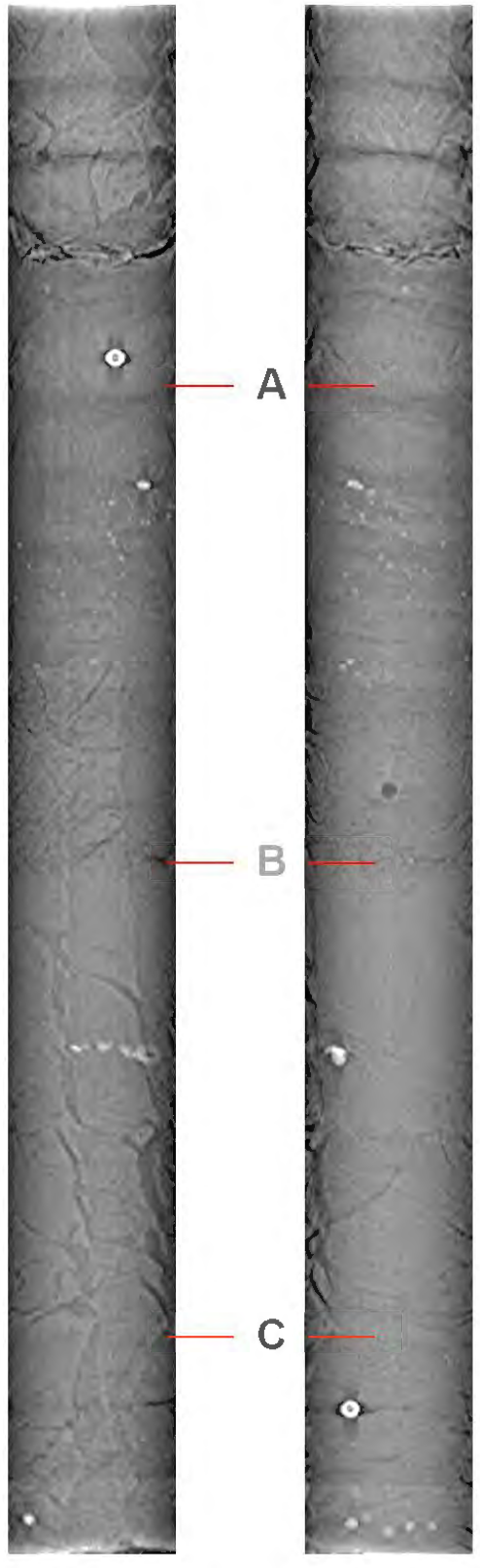

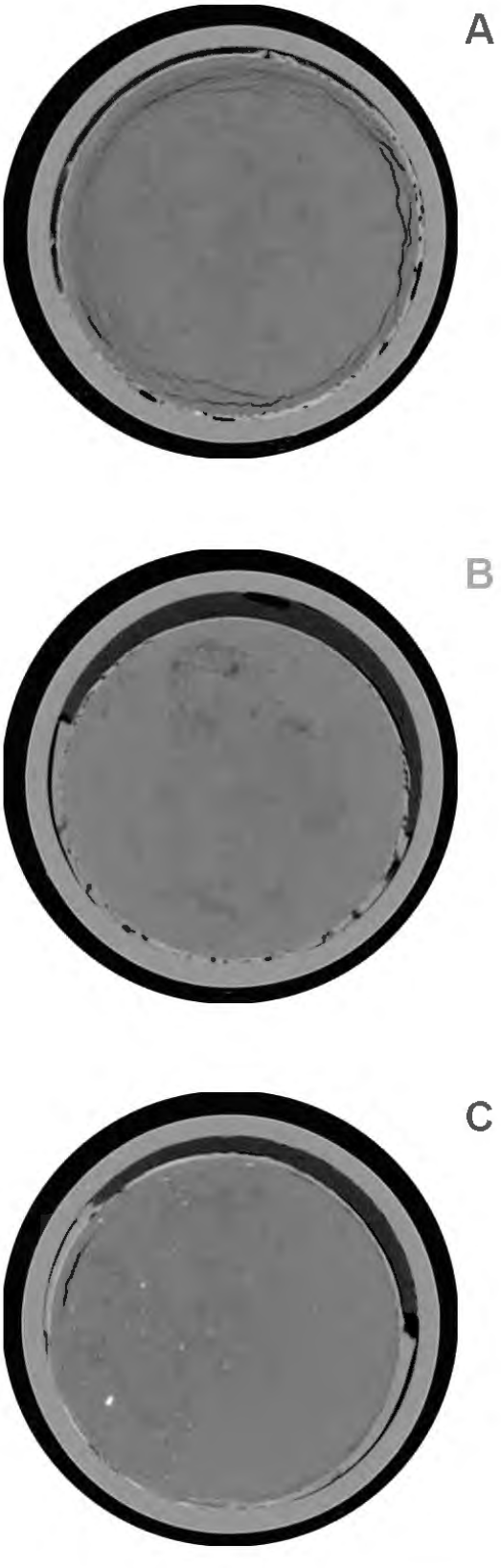

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Pacific Gas and Electric Company

Piacentine 2-27

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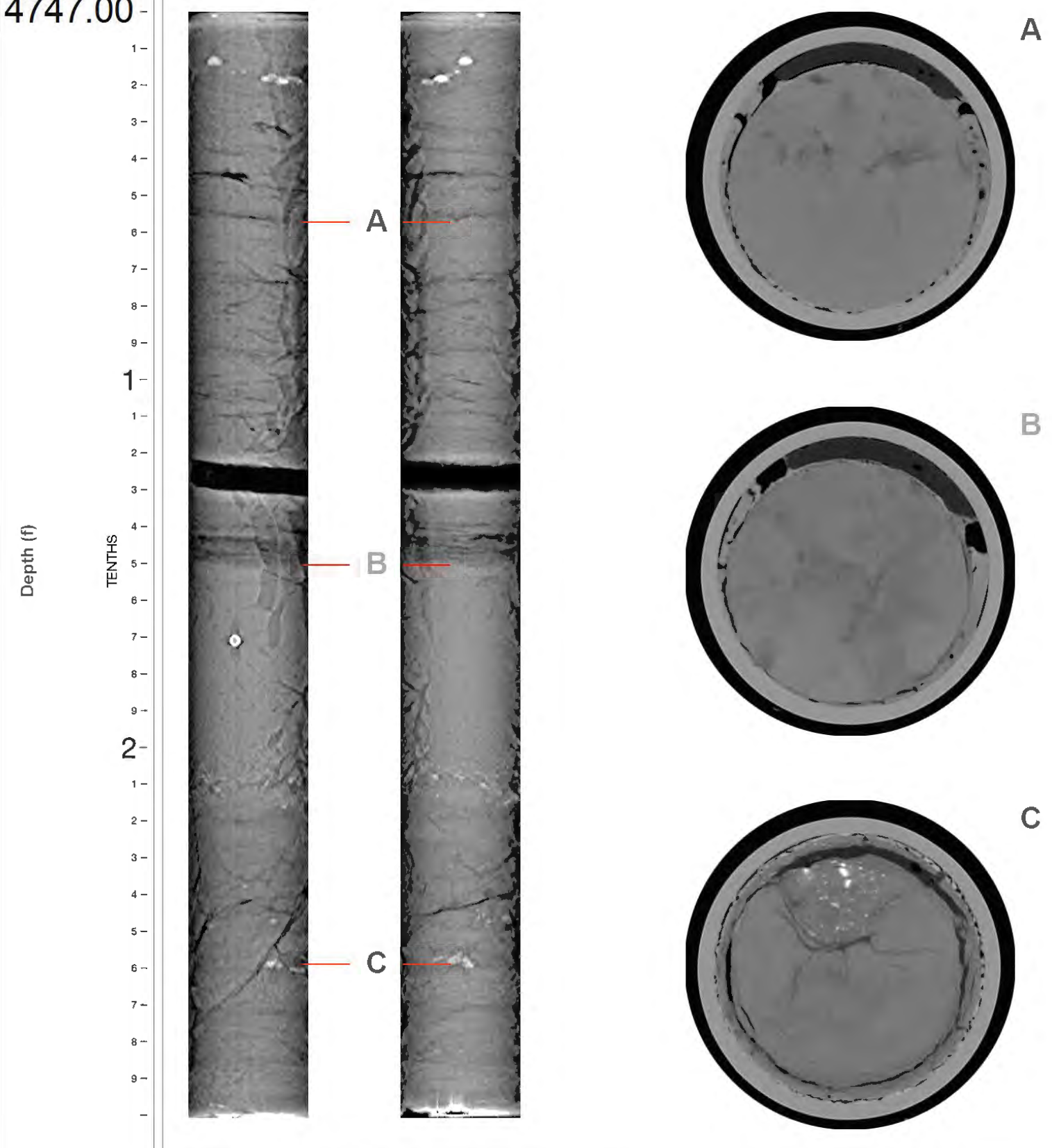

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Pacific Gas and Electric Company

Piacentine 2-27

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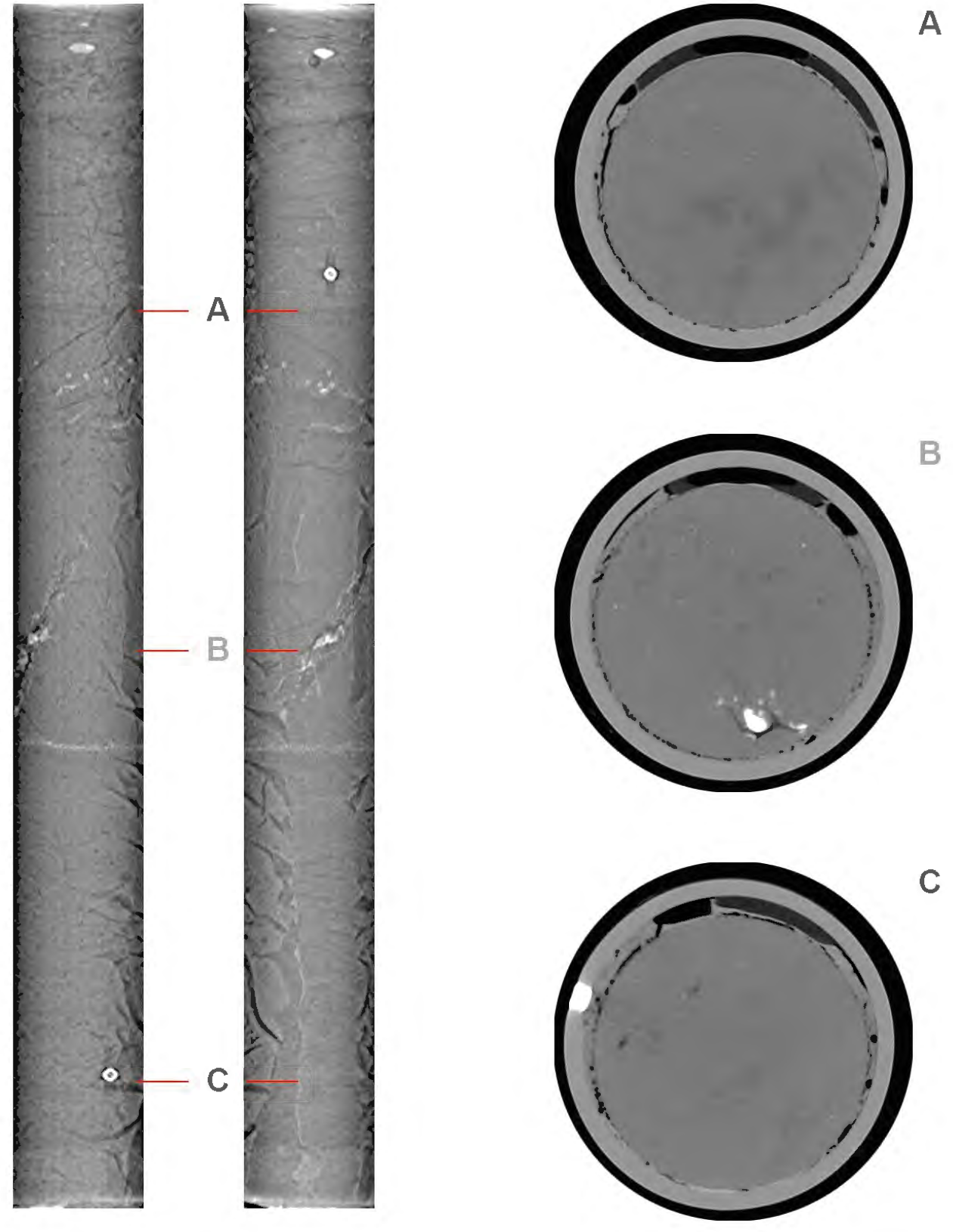

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Pacific Gas and Electric Company

Piacentine 2-27

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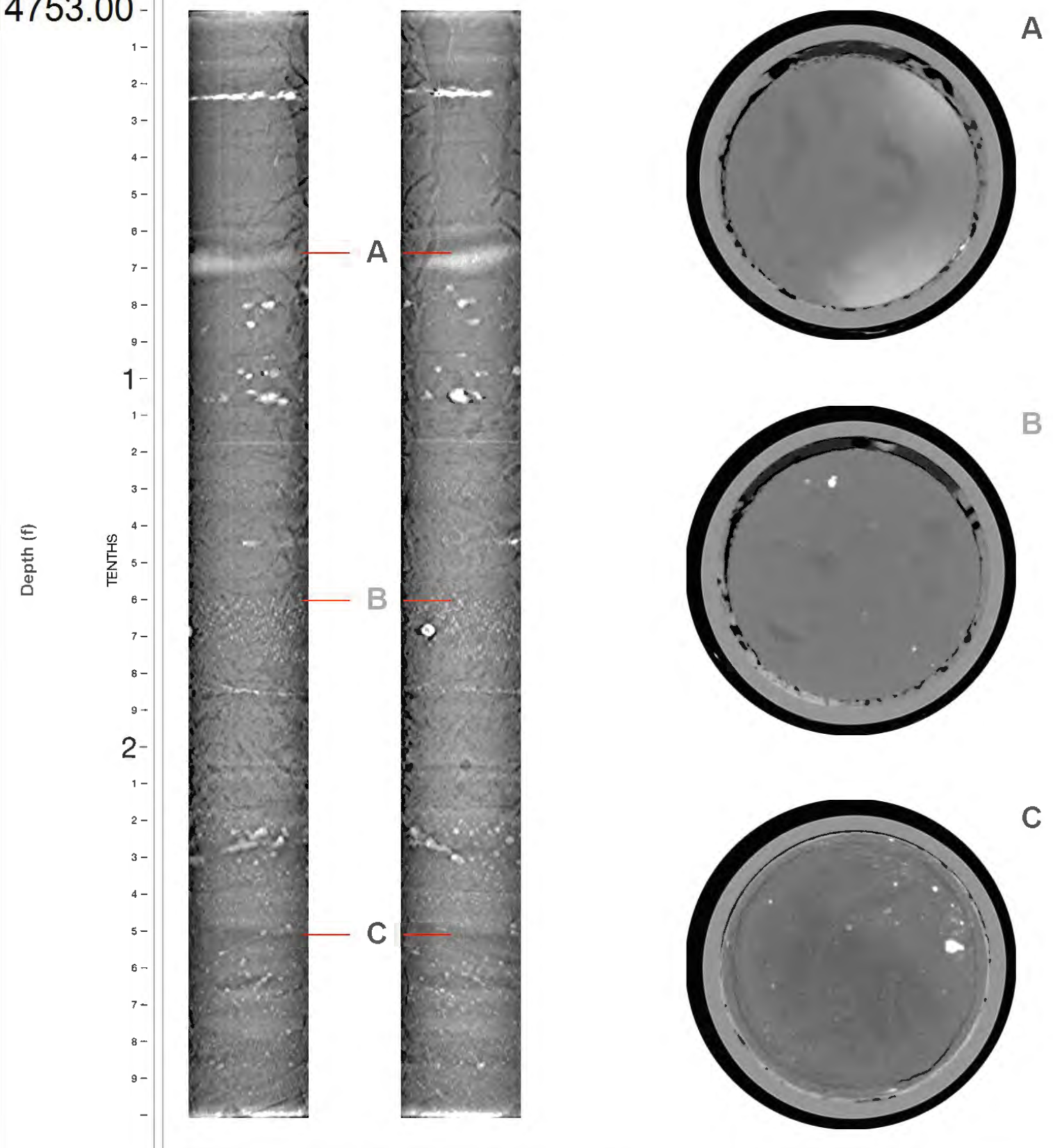

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Pacific Gas and Electric Company

Piacentine 2-27

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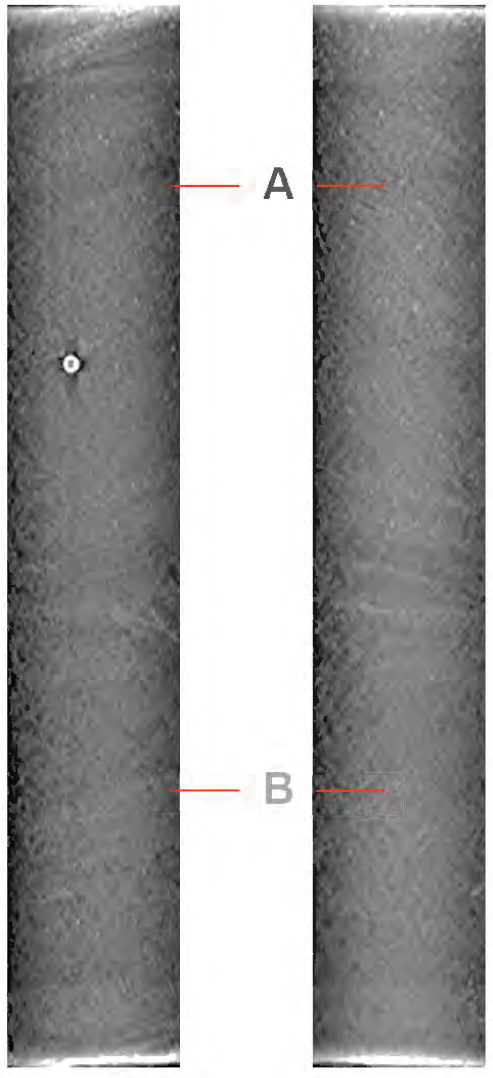
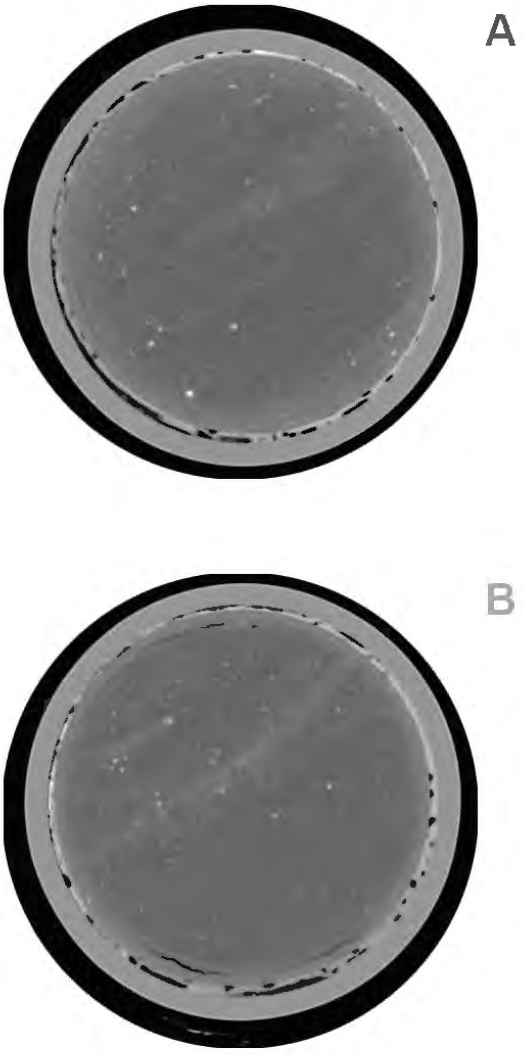




UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

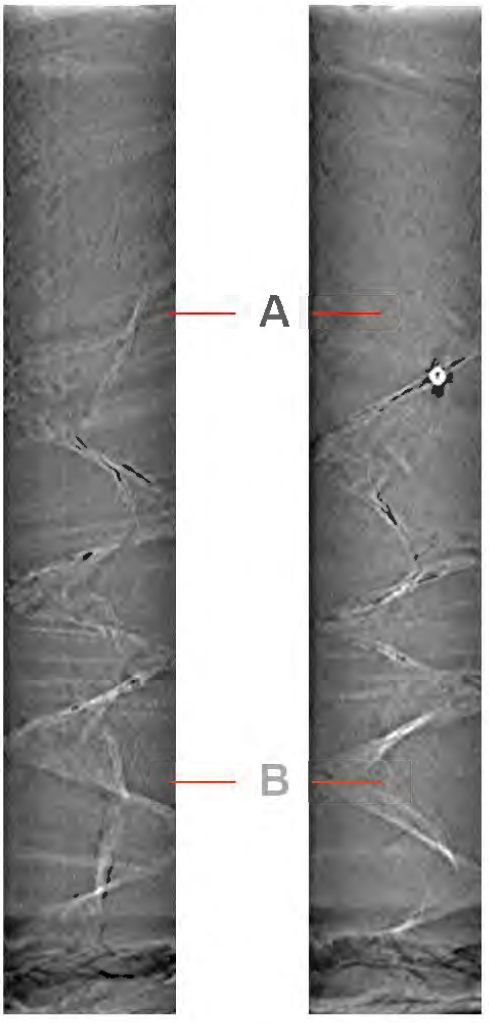
File No.: 113011PG

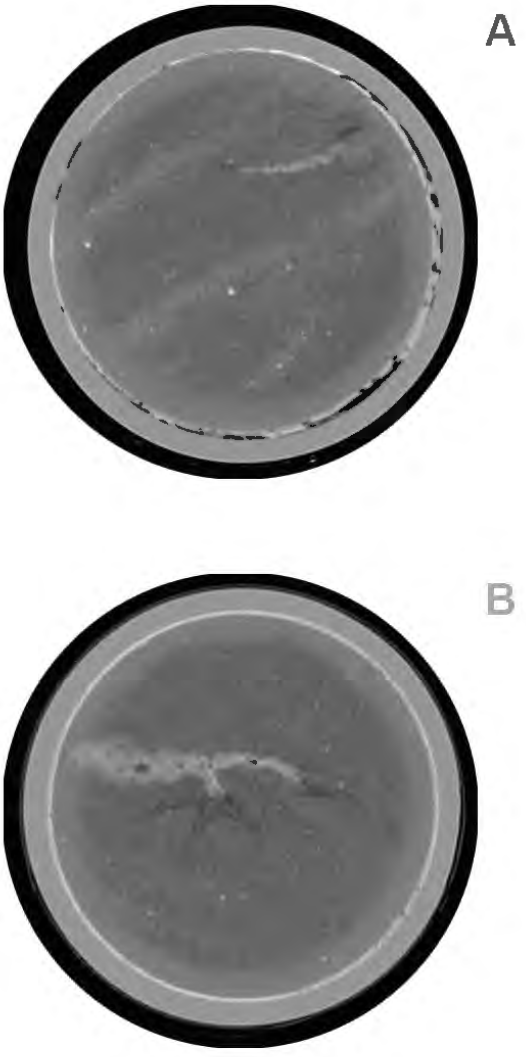
0°	90°	Axials

4758.00

Depth (f)

TENTHS





UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

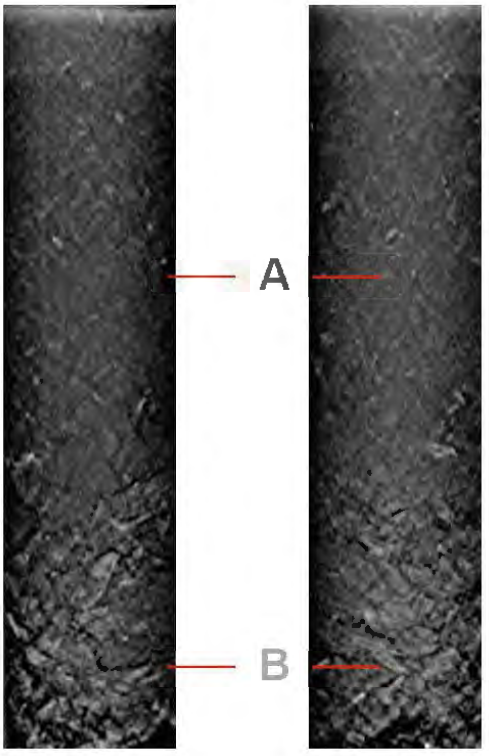
File No.: 113011PG

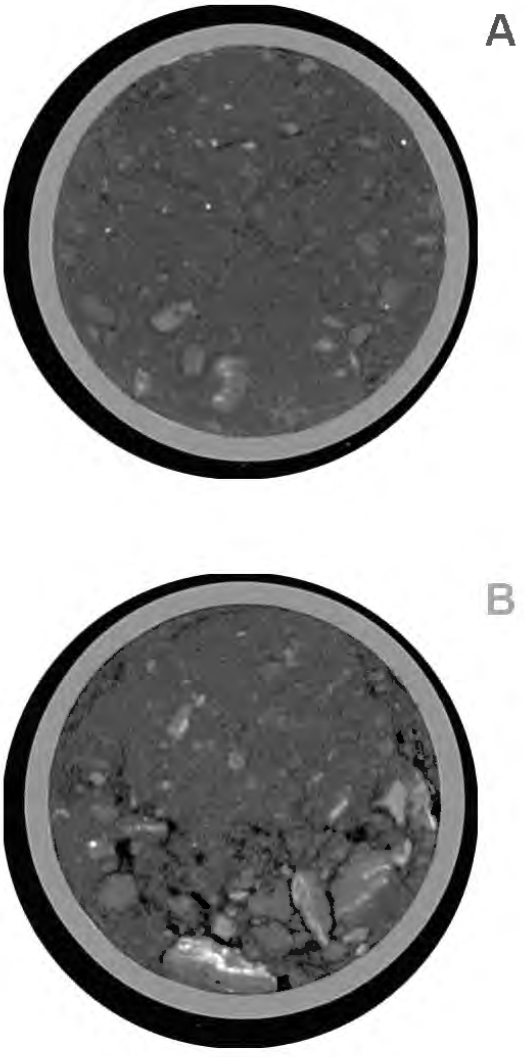
0°	90°	Axials

4759.90

Depth (f)

TENTHS





UltraScan

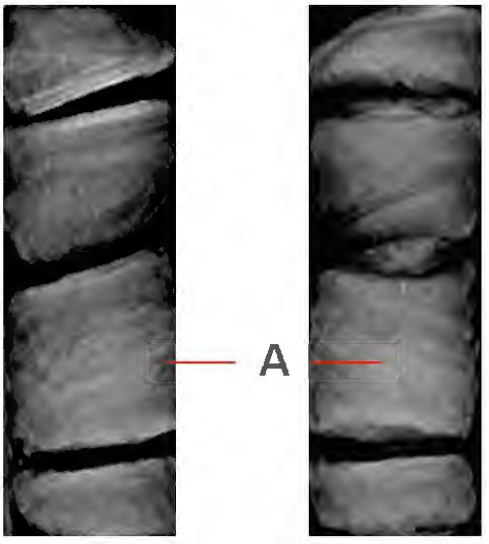
Pacific Gas and Electric Company

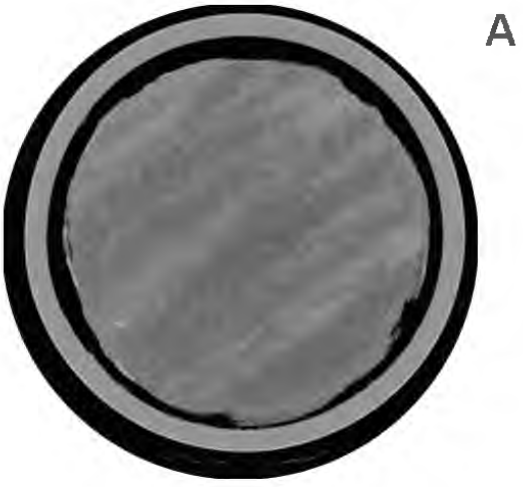
Piacentine 2-27

File No.: 113011PG

0°	90°	Axials

4761.30





Depth (ft)

TENTHS

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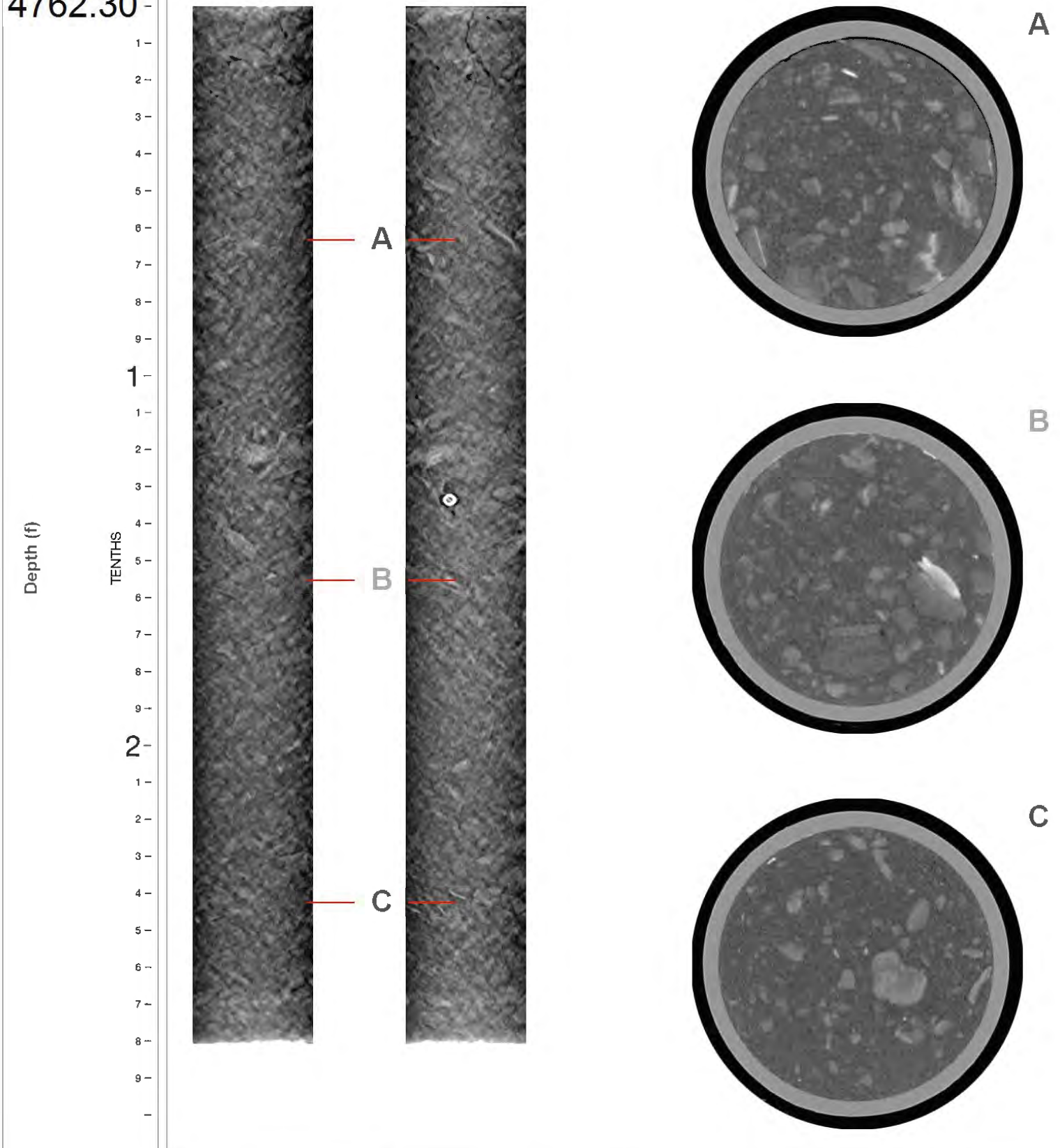
Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

0°	90°	Axials



UltraScan

Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

0°	90°	Axials

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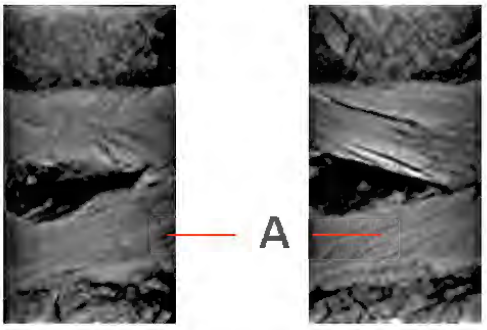

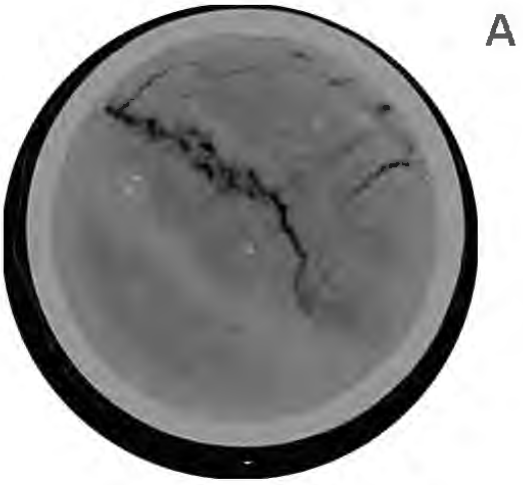

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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Depth (f)

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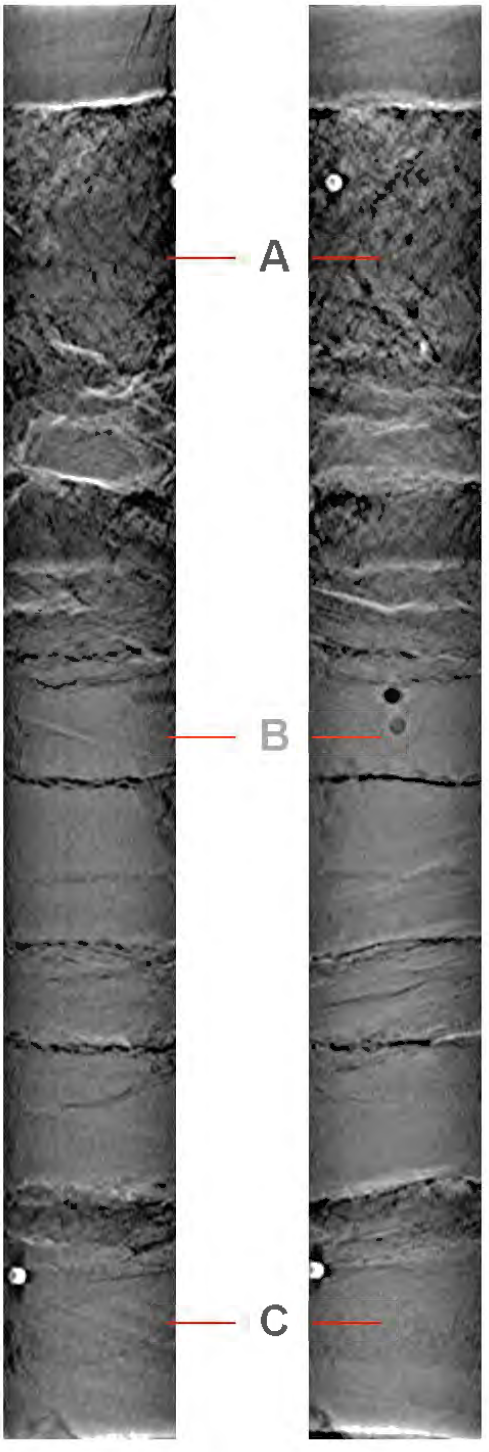

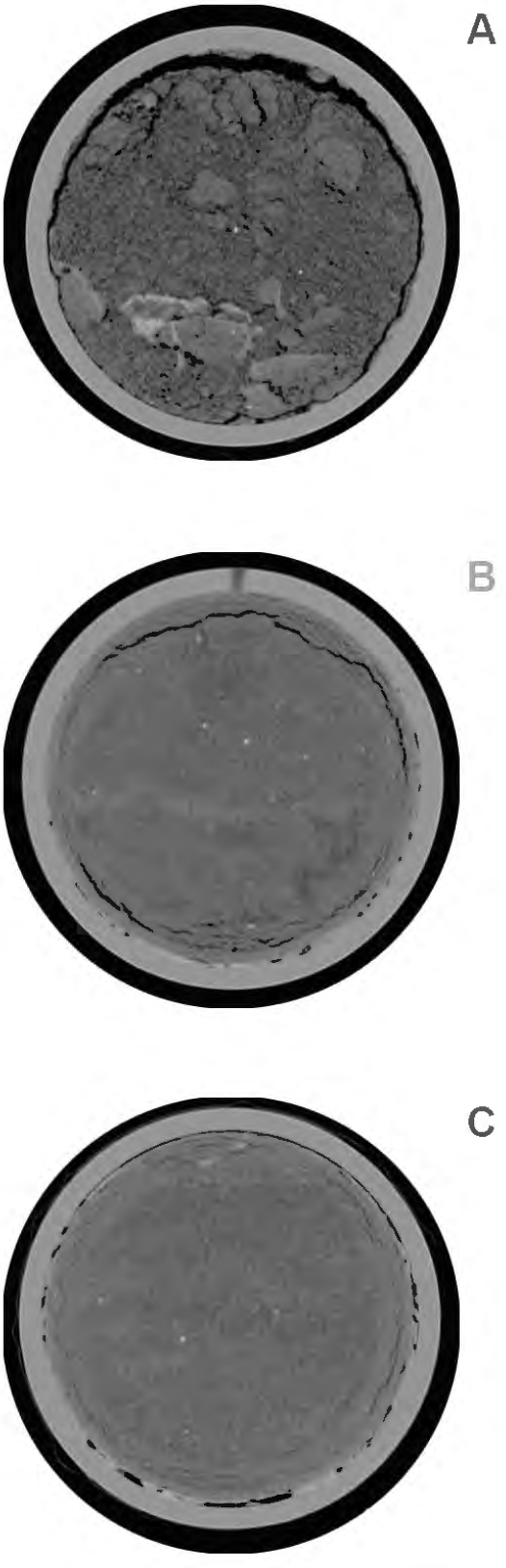

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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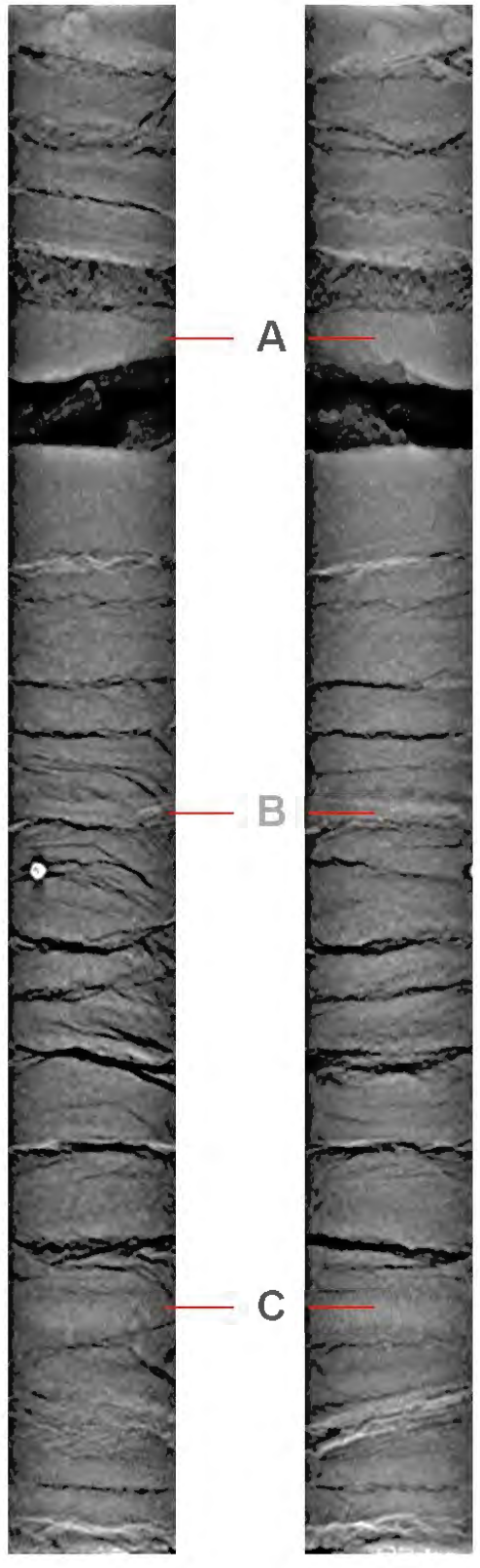

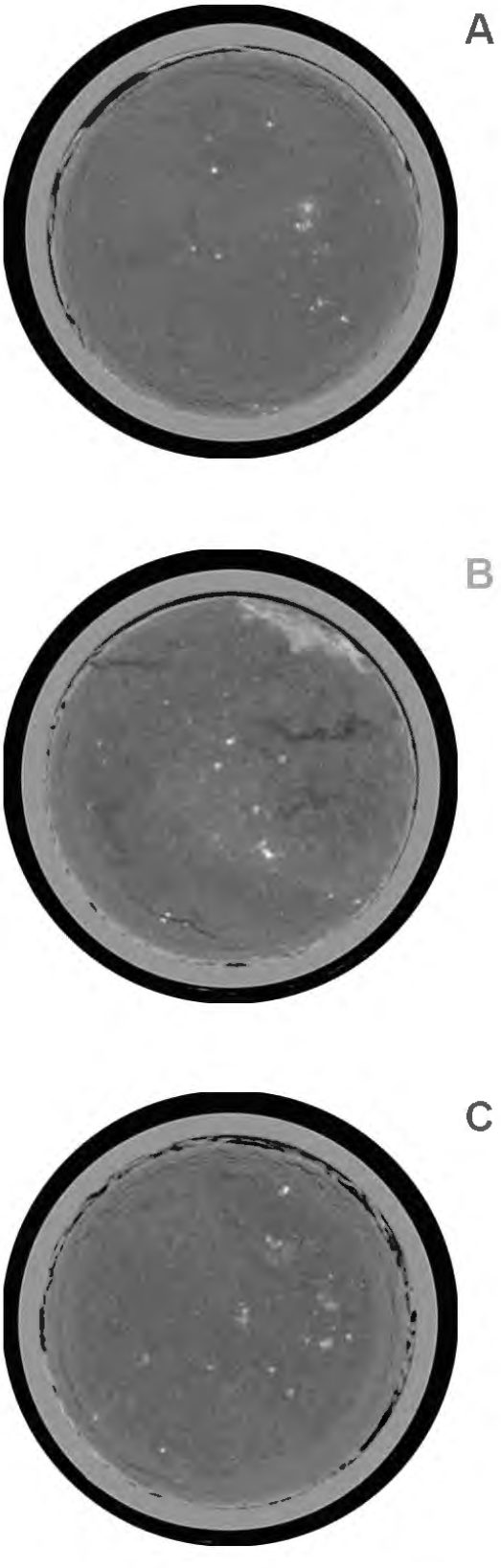

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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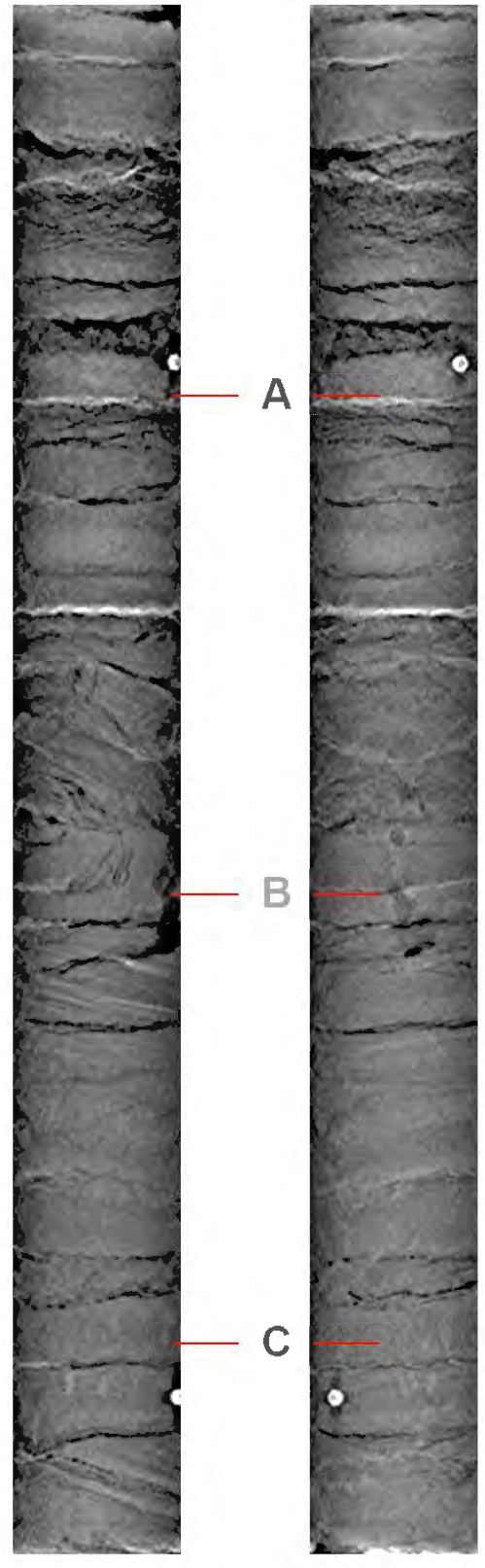

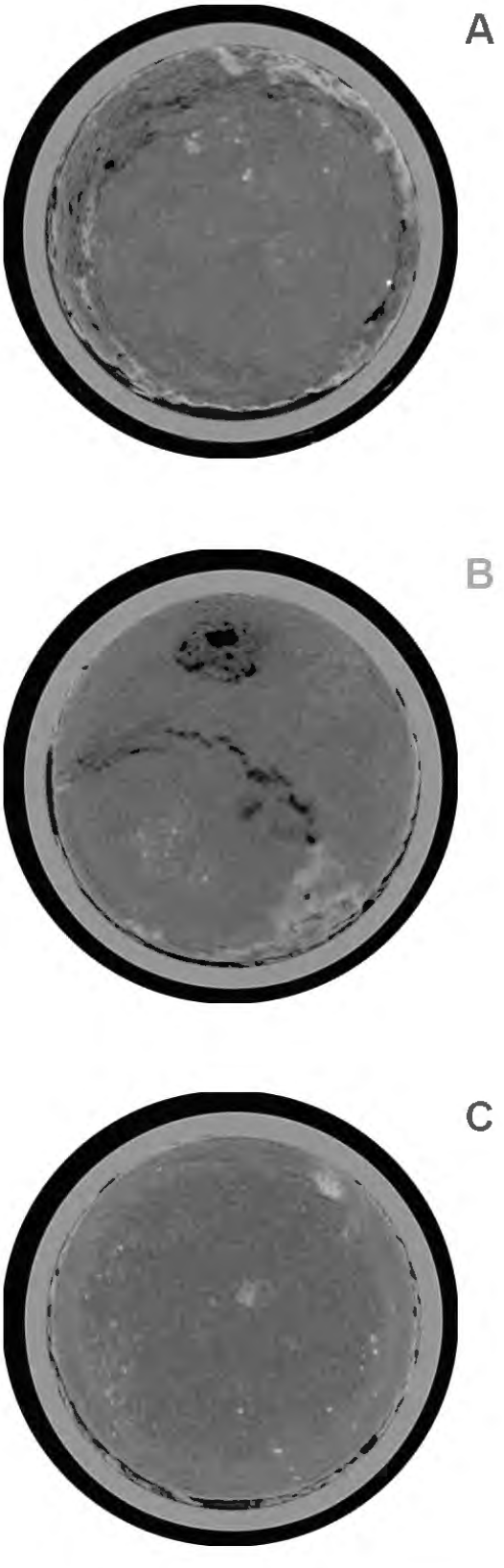

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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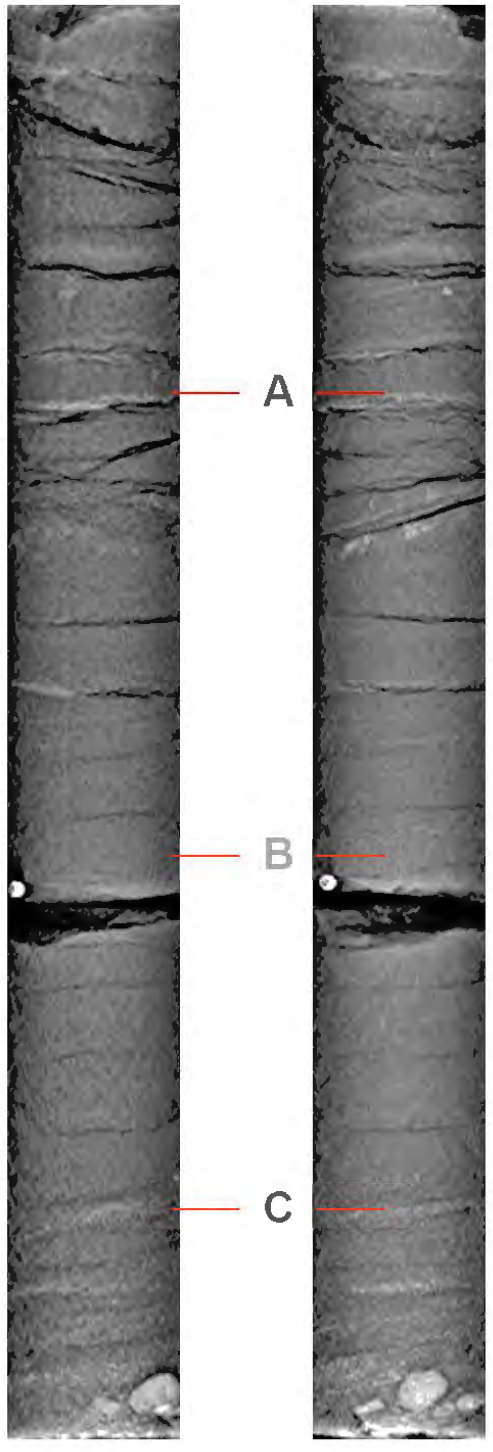



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Pacific Gas and Electric Company

Piacentine 2-27

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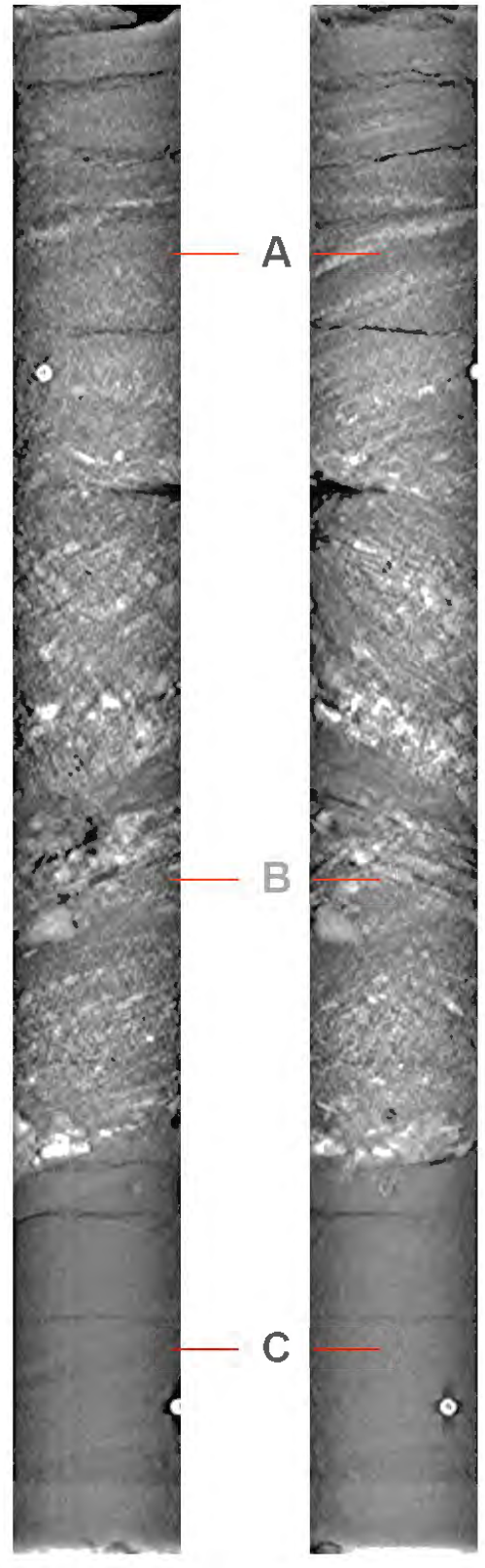

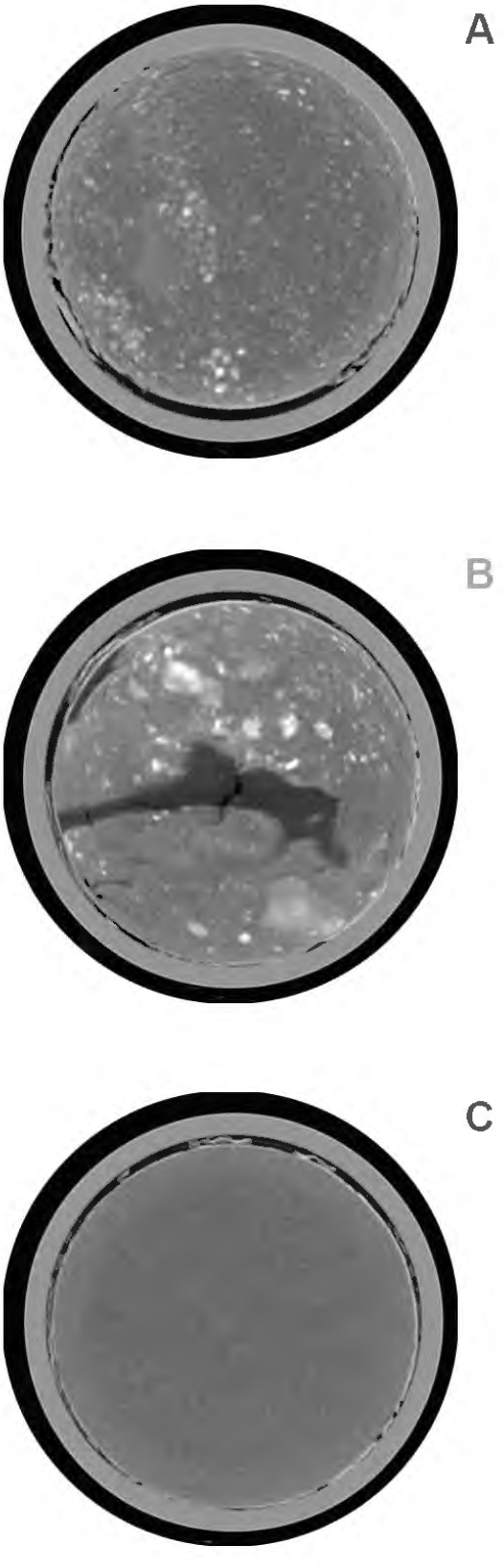

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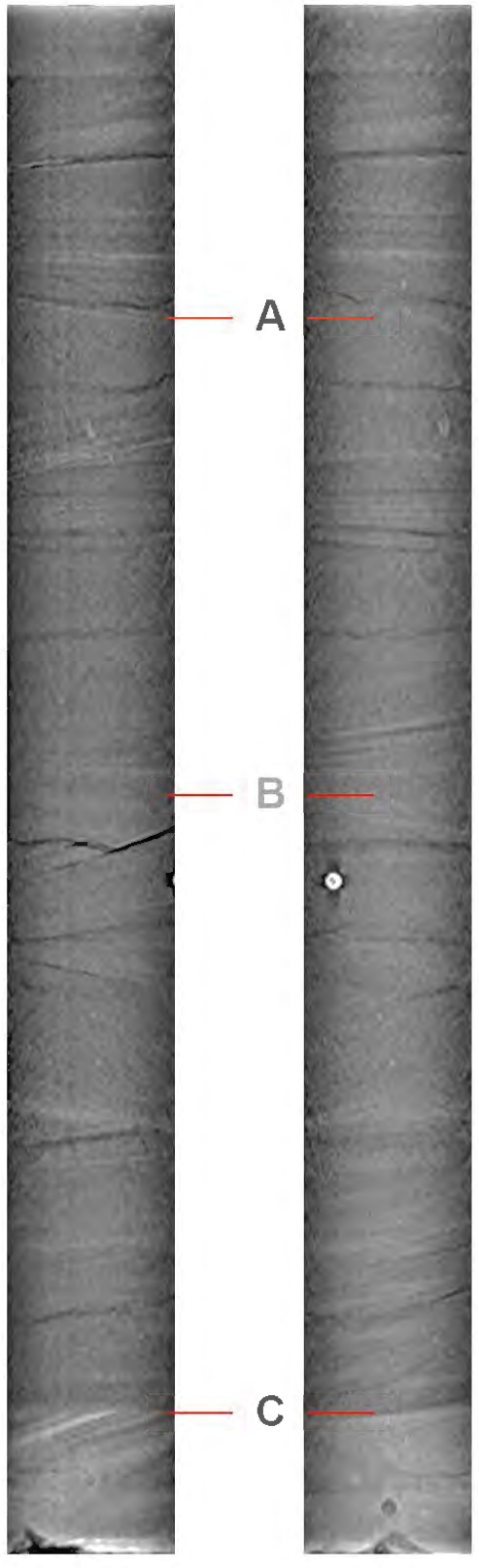

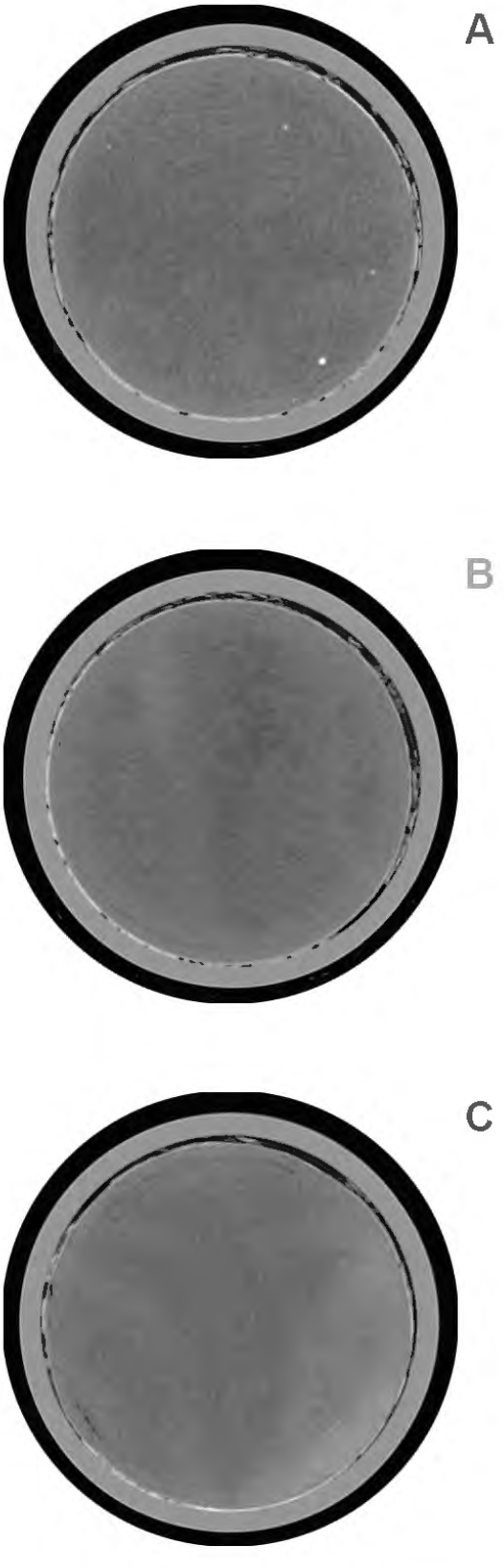

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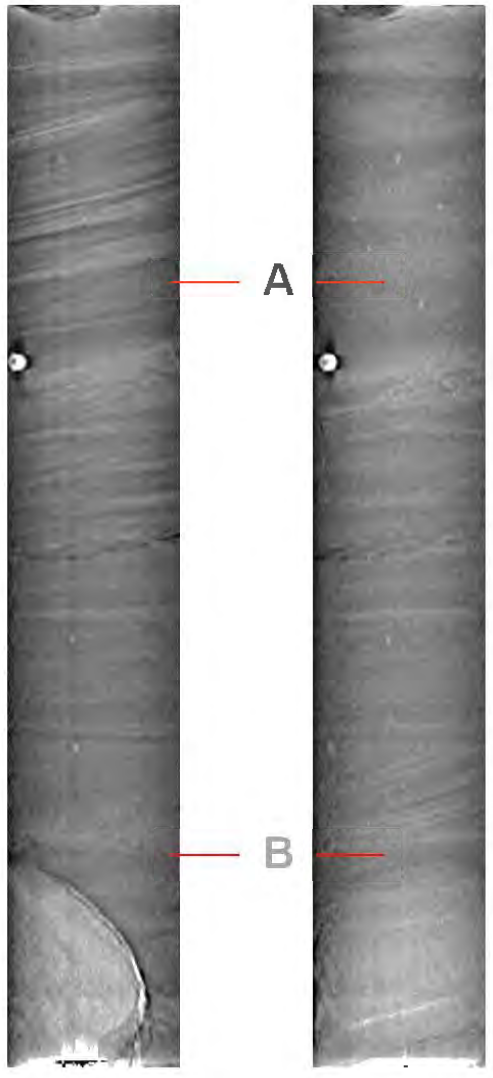

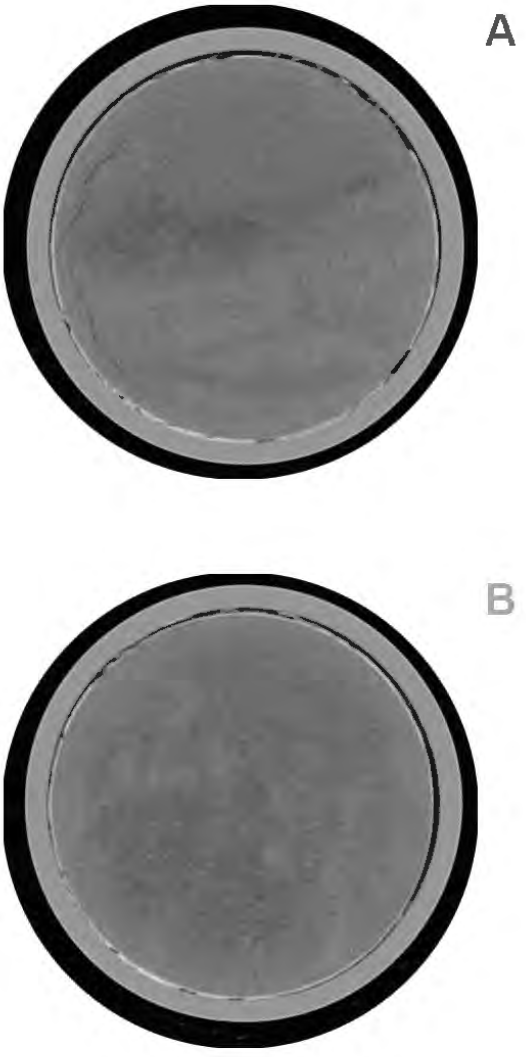

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

0°	90°	Axials

4785.10

Depth (f)

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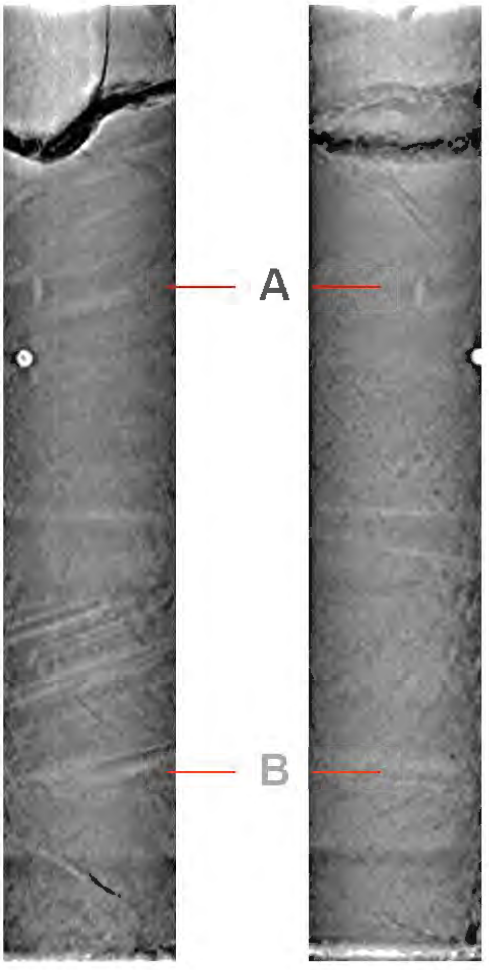

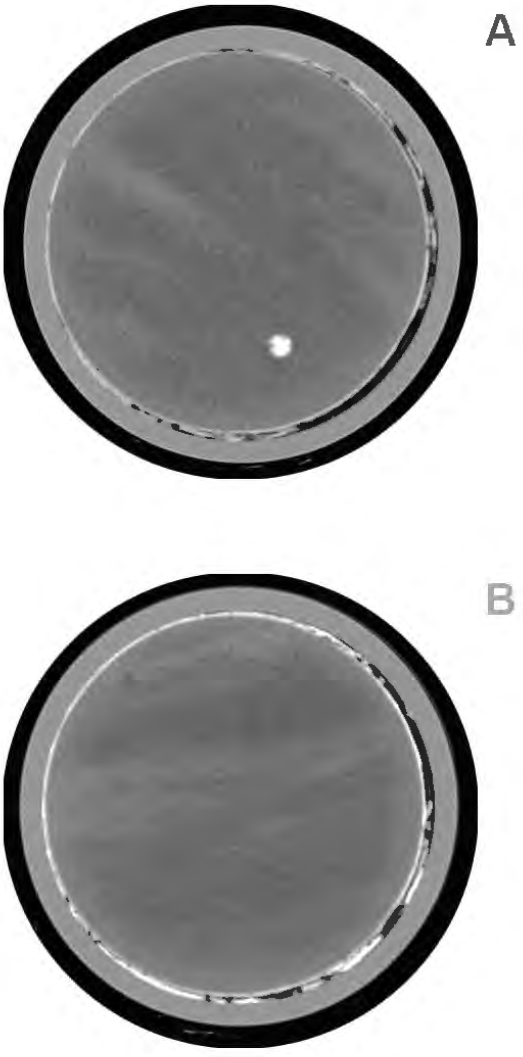

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Pacific Gas and Electric Company

Piacentine 2-27

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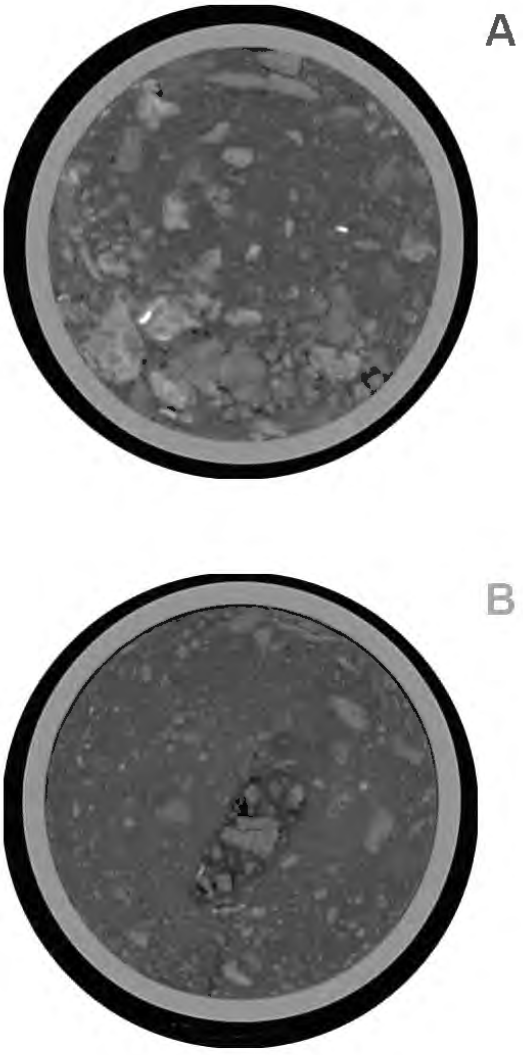

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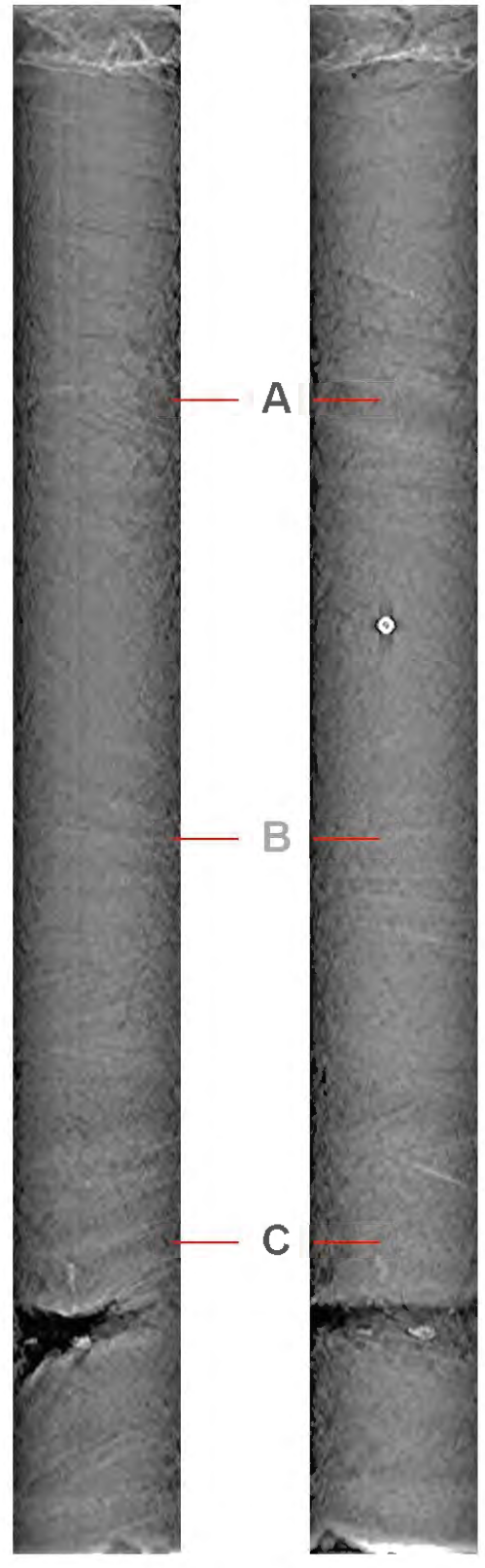

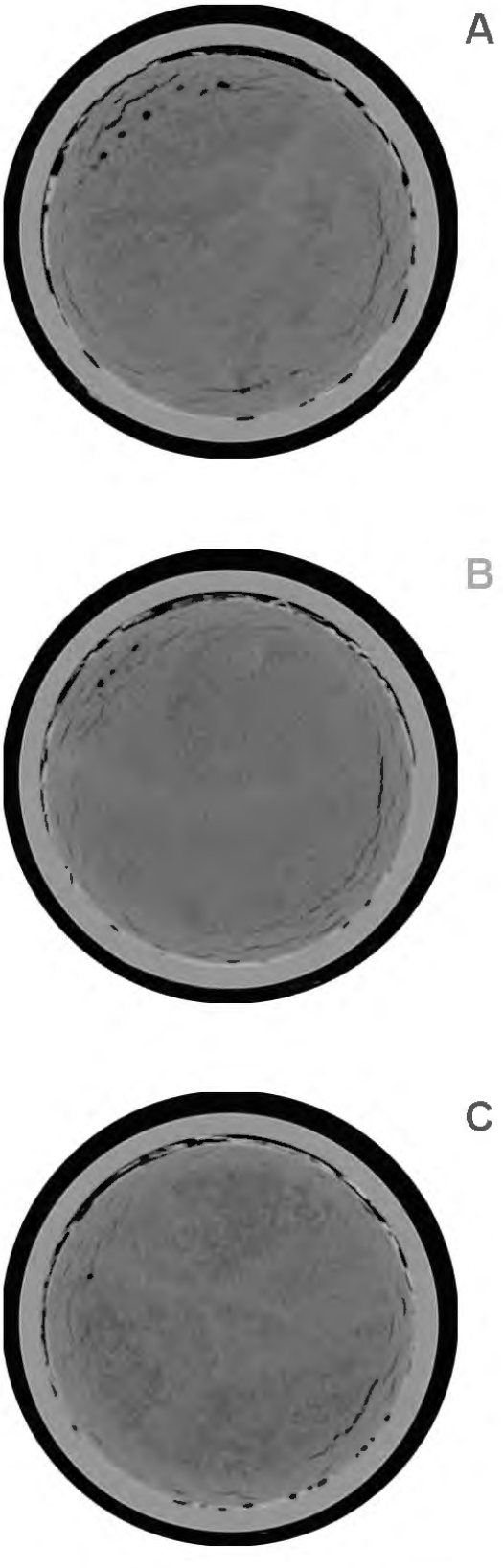

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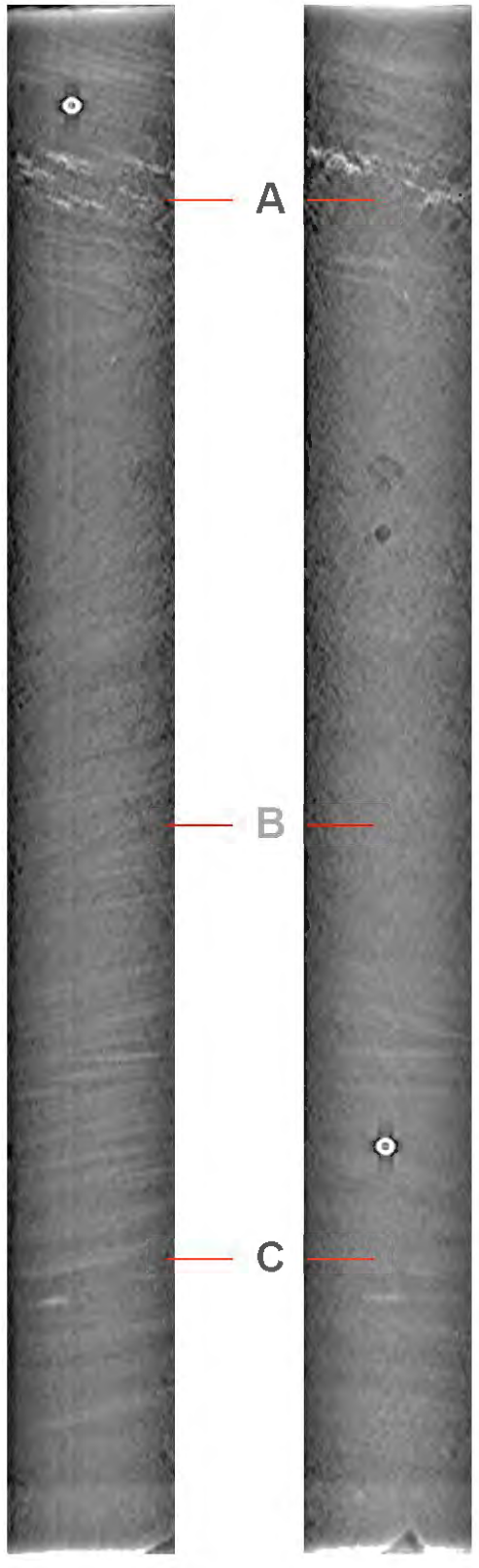

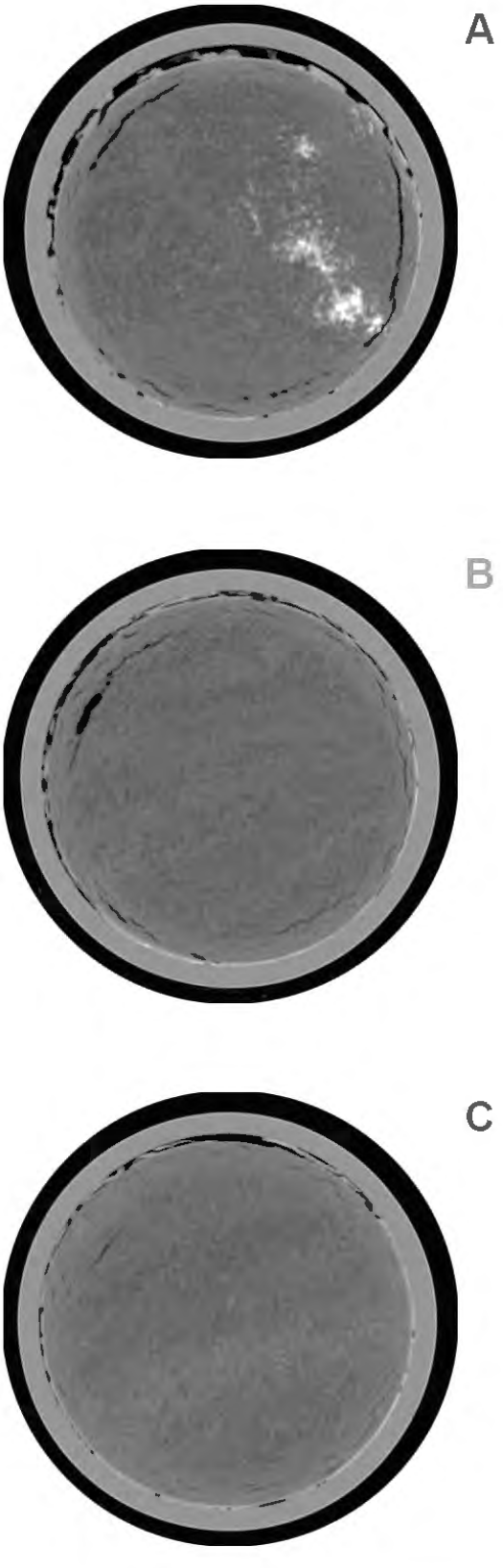

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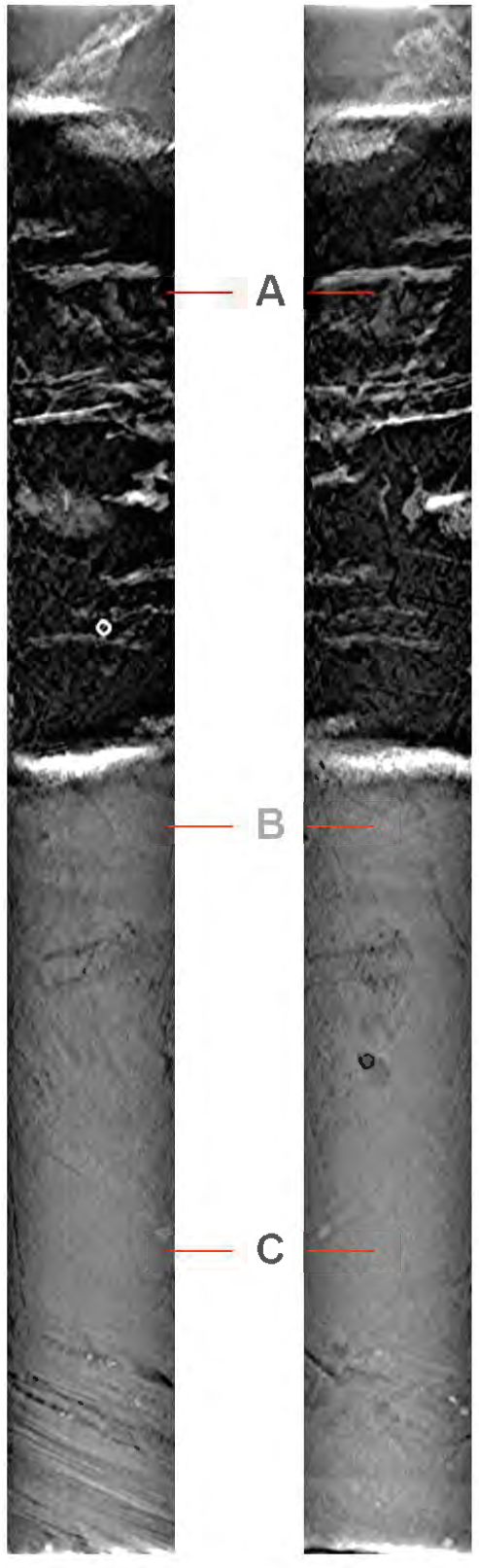

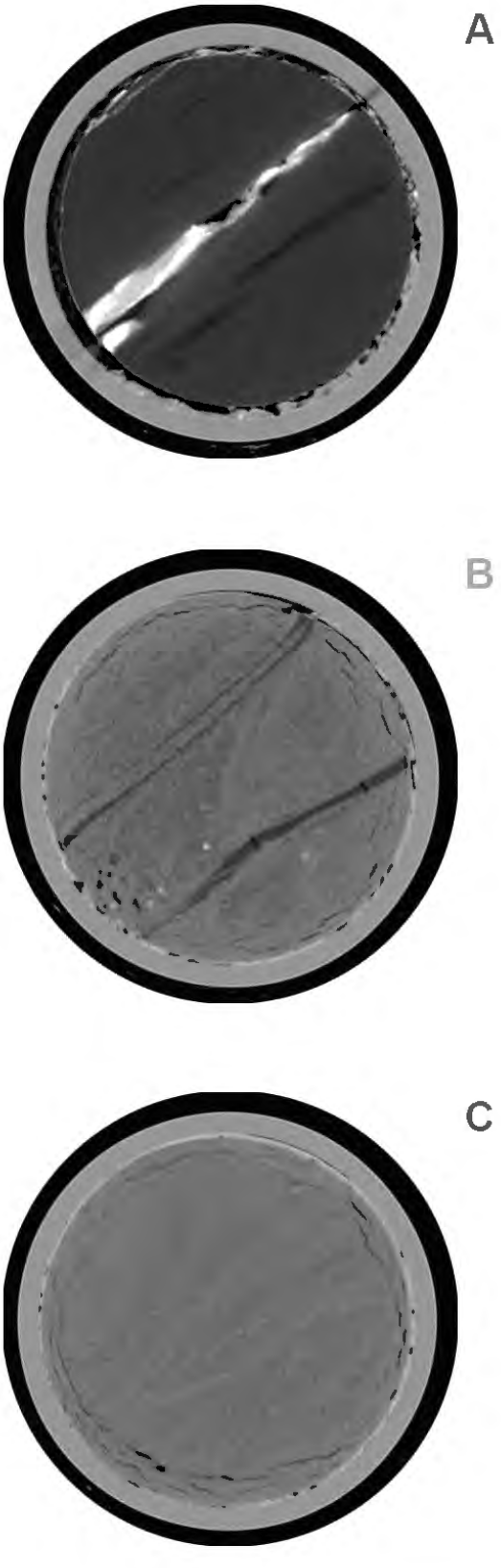

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Pacific Gas and Electric Company

Piacentine 2-27

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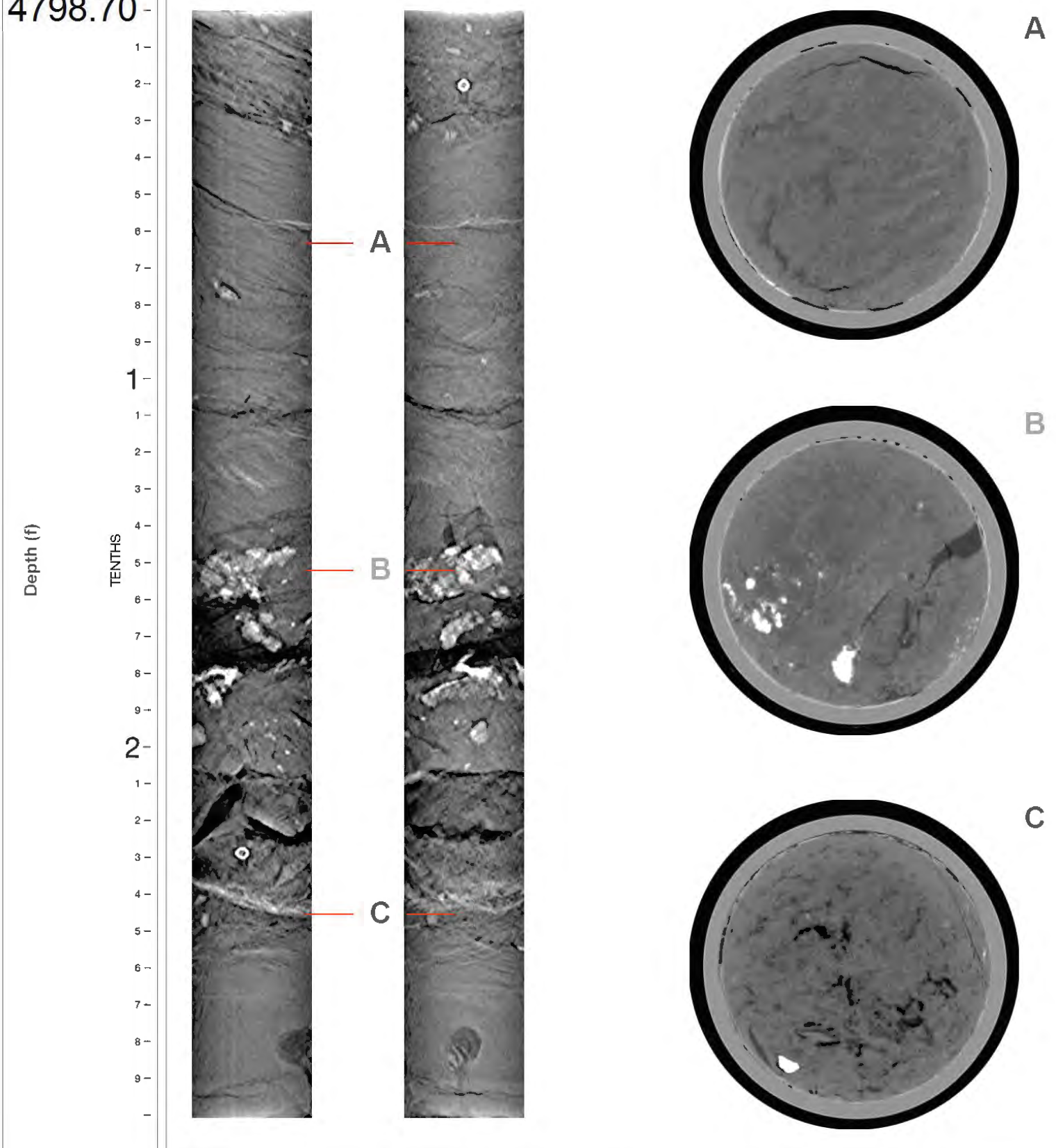

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Pacific Gas and Electric Company

Piacentine 2-27

File No.: 113011PG

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Depth (f)

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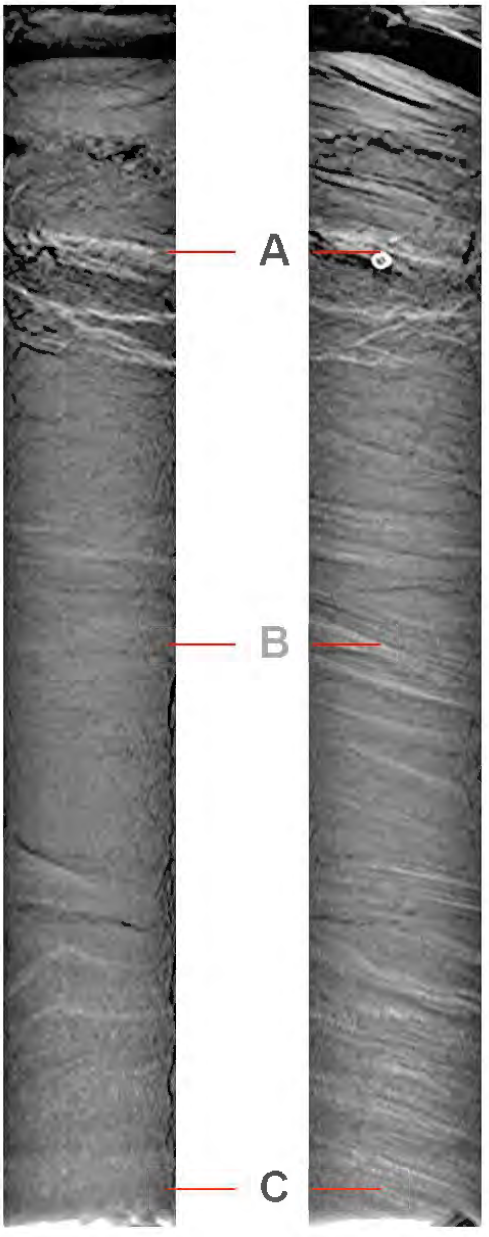

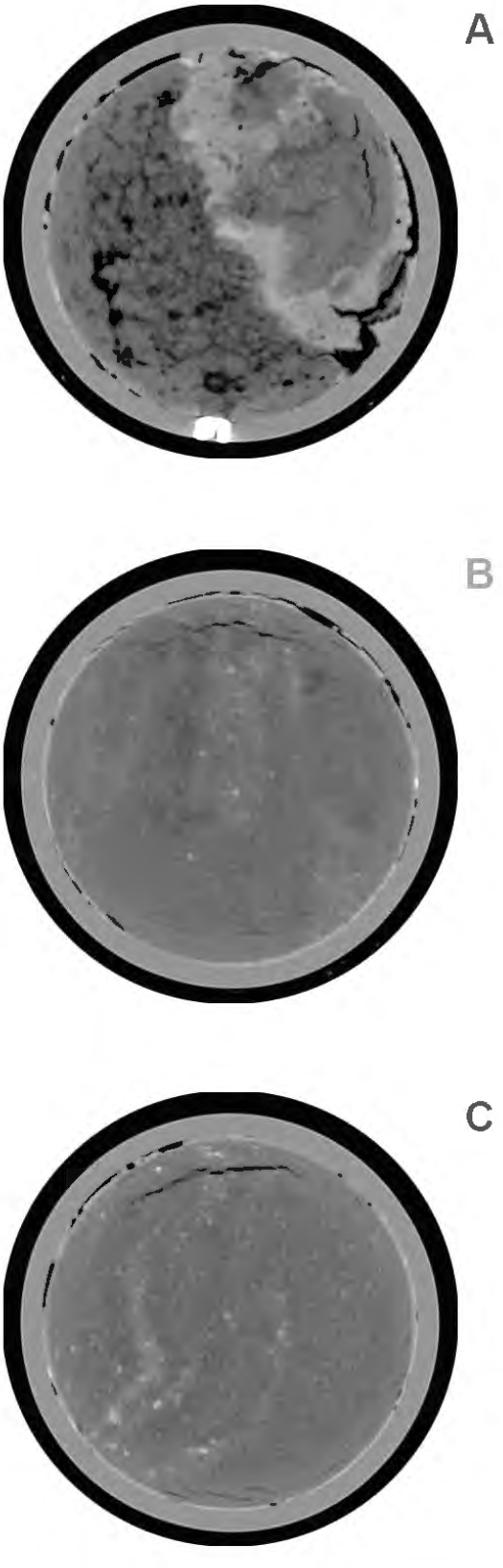

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Pacific Gas and Electric Company

Piacentine 2-27

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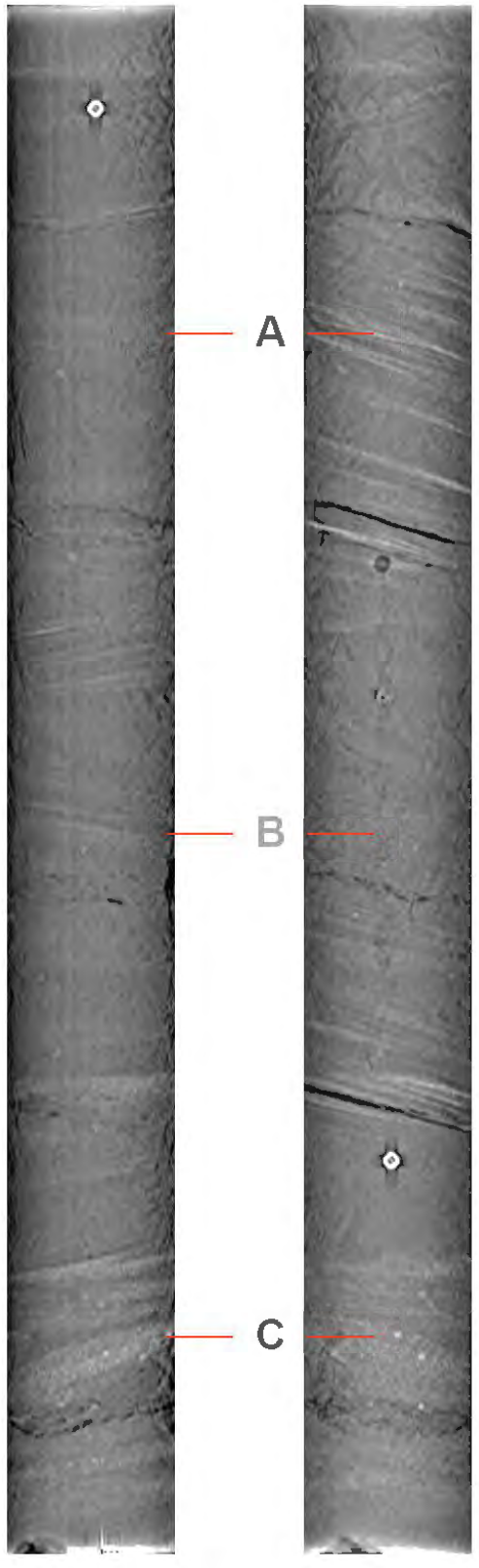

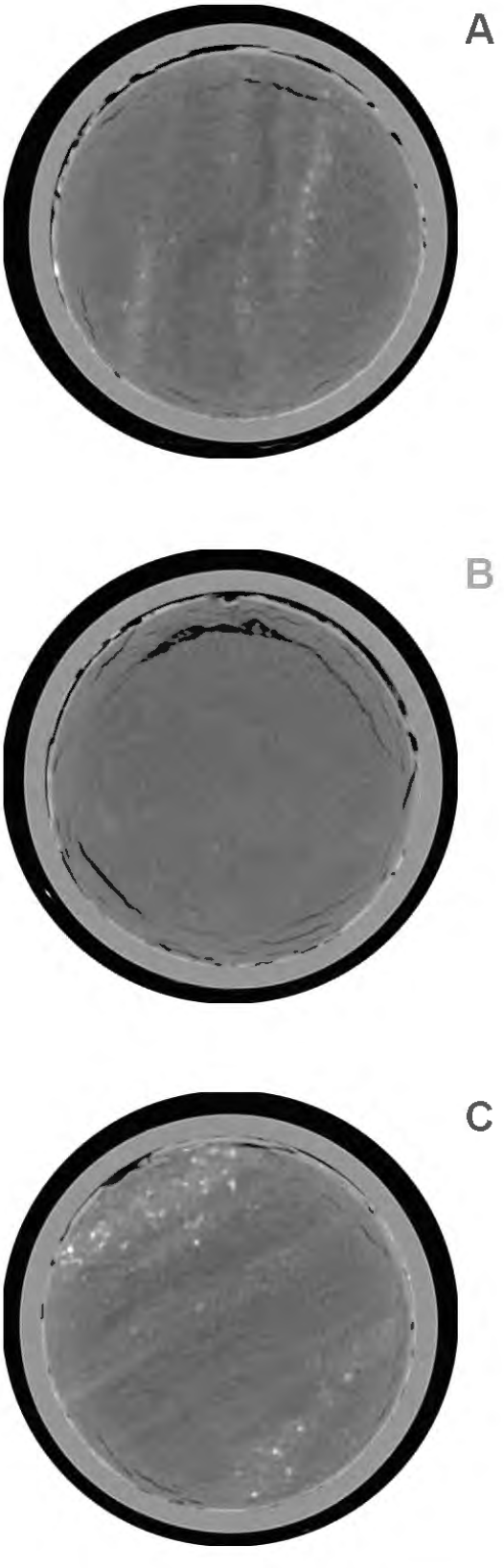

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Pacific Gas and Electric Company

Piacentine 2-27

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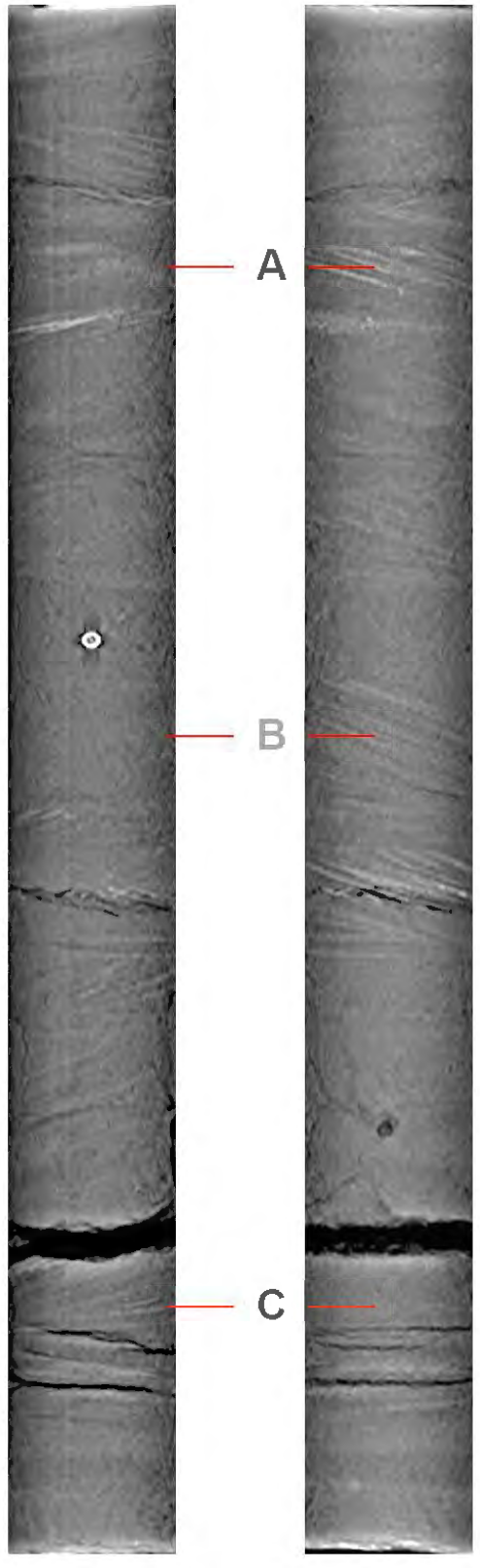

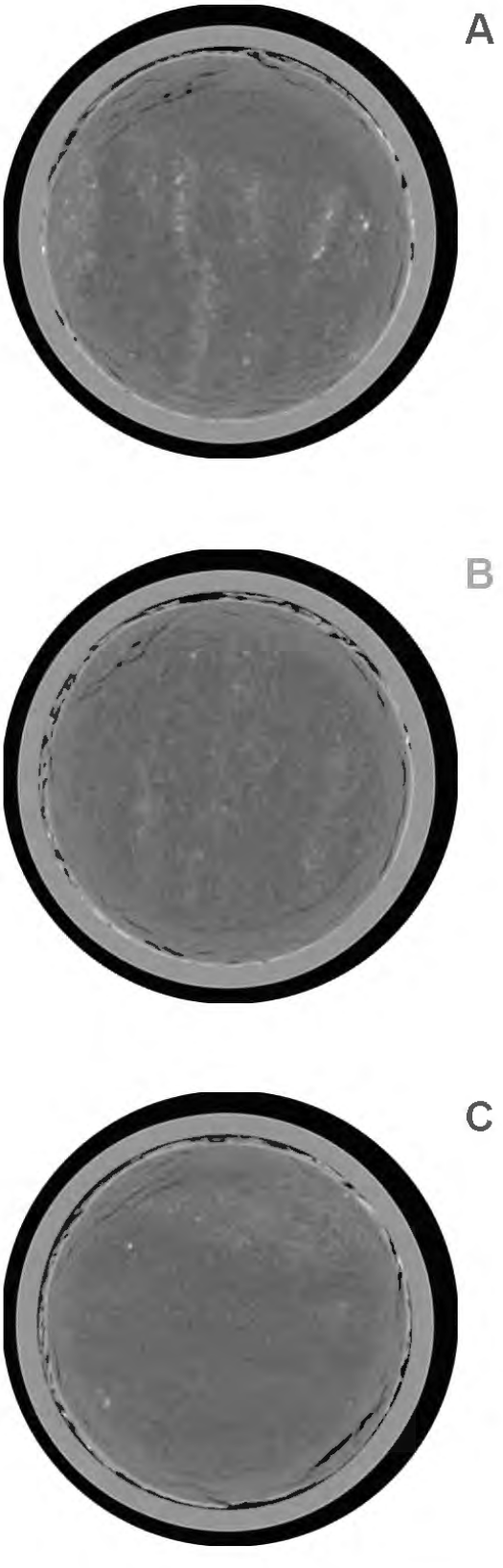

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Pacific Gas and Electric Company

Piacentine 2-27

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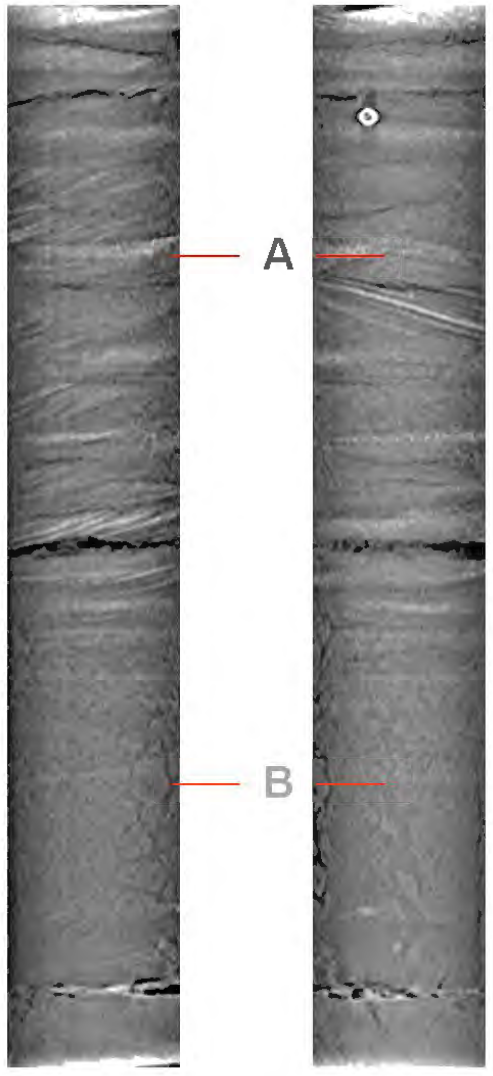

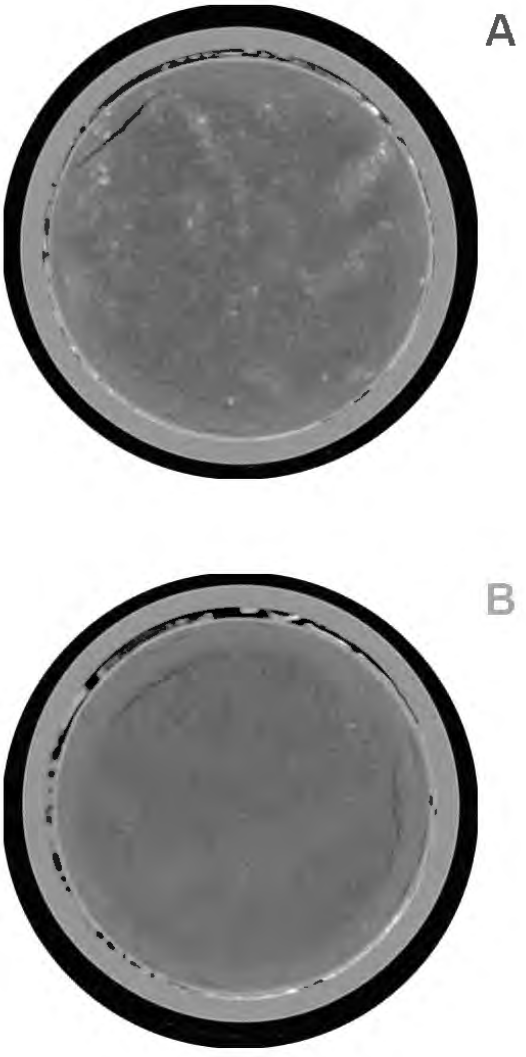

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Piacentine 2-27

File No.: 113011PG

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Depth (f)

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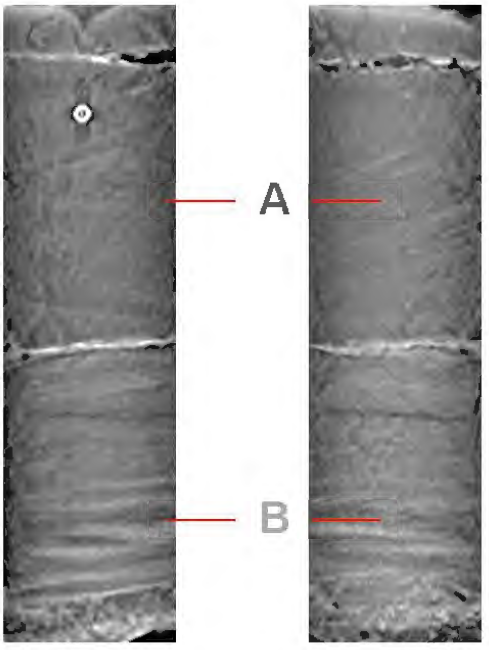





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Piacentine 2-27

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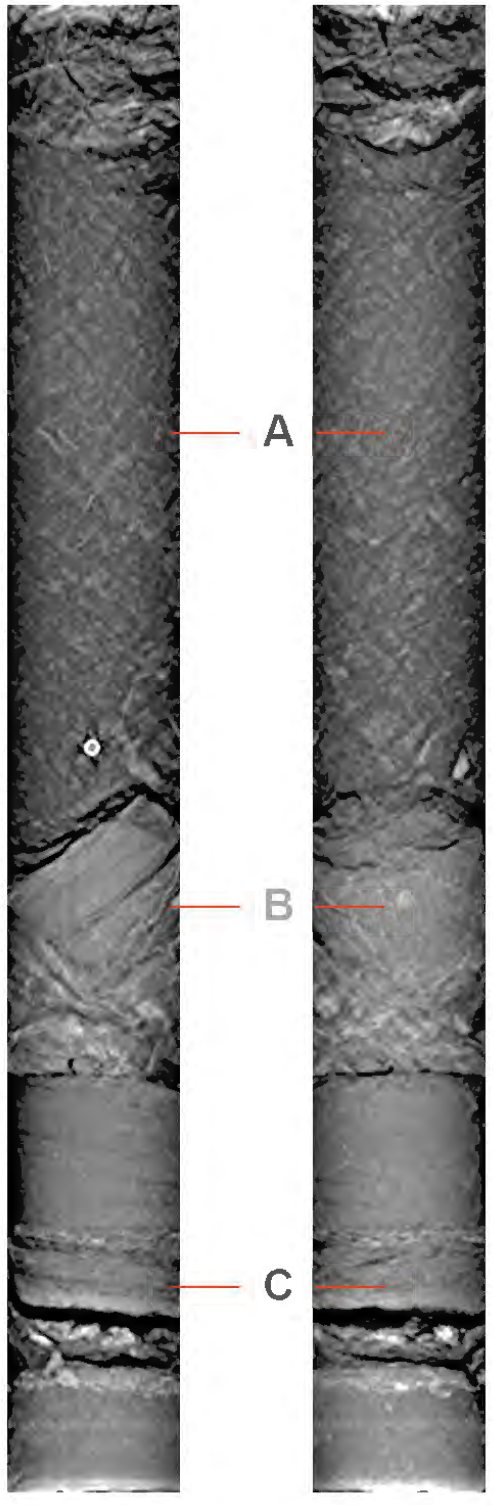

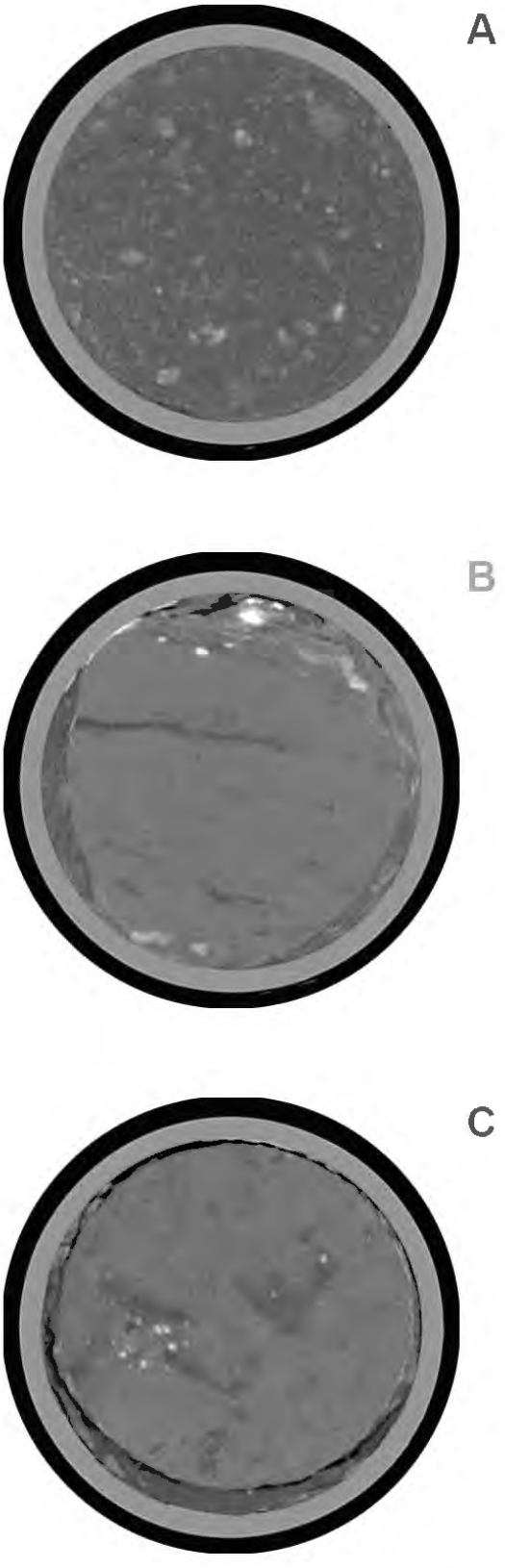

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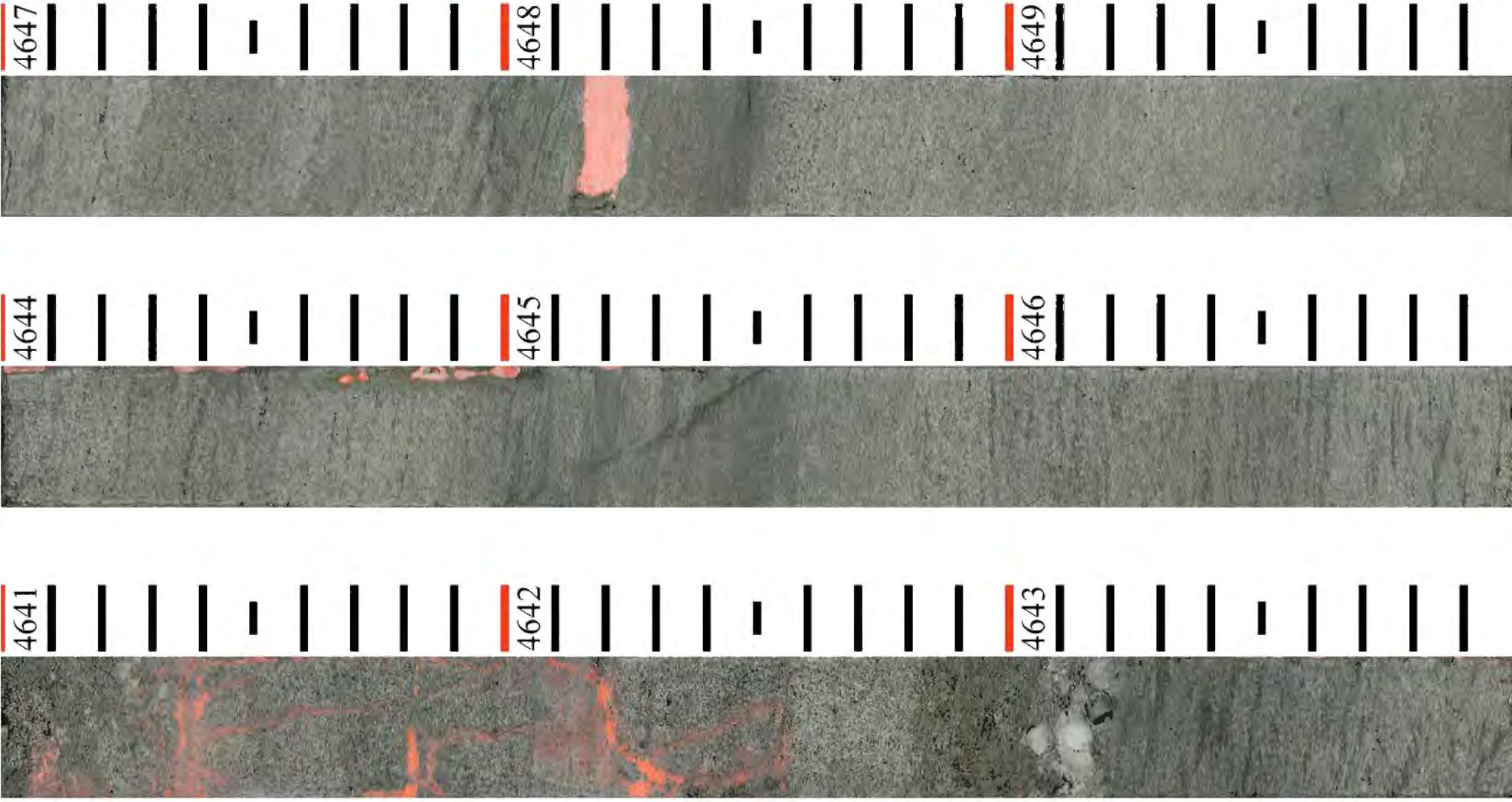

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FIELD: King Island

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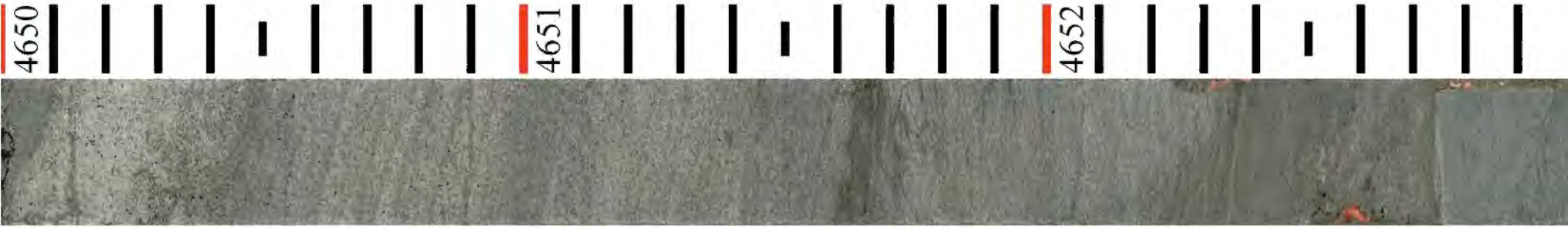

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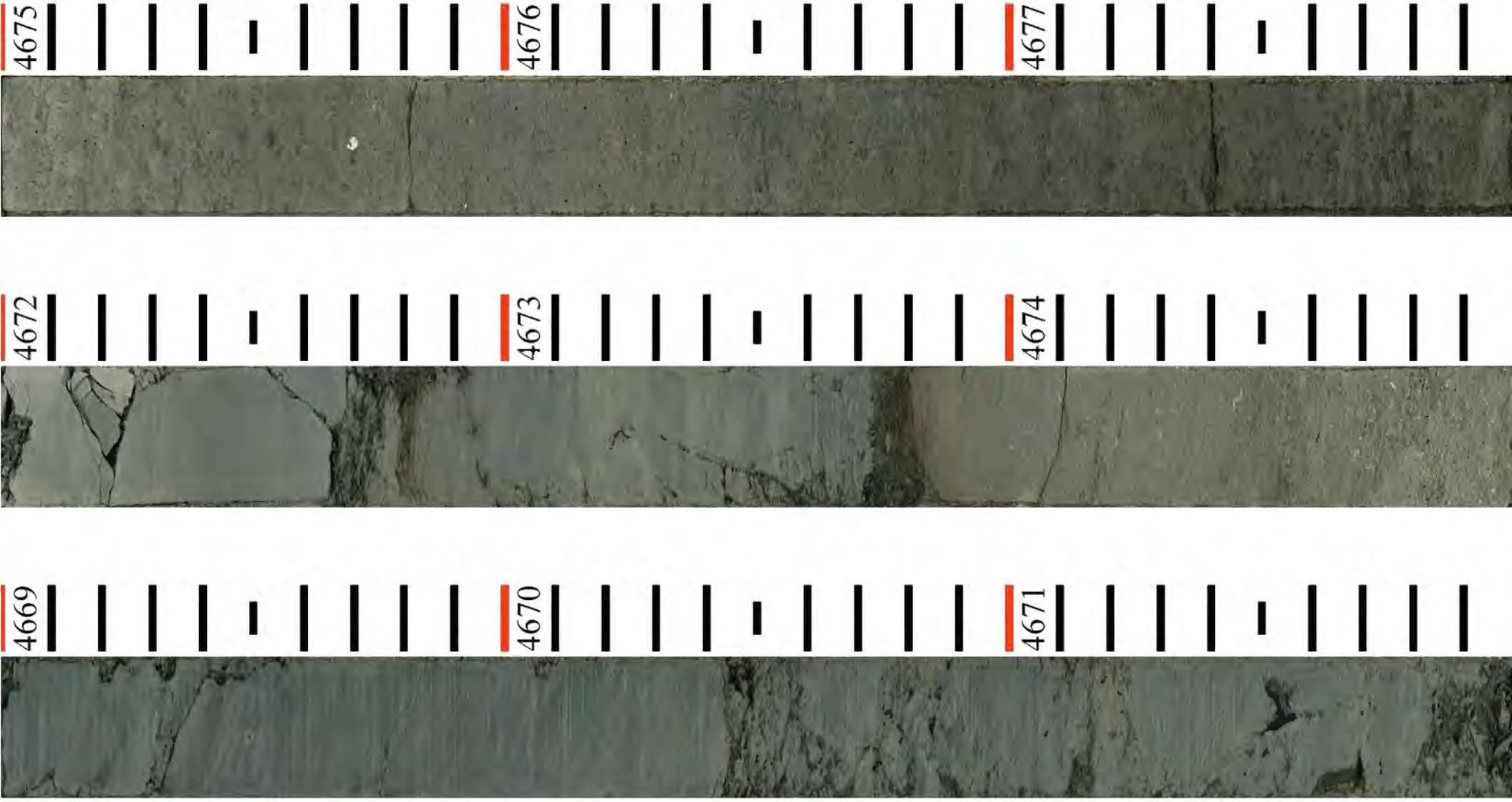

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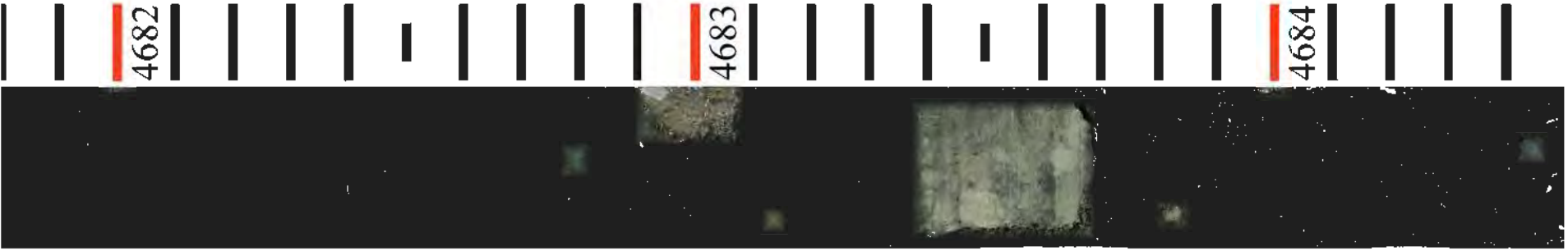



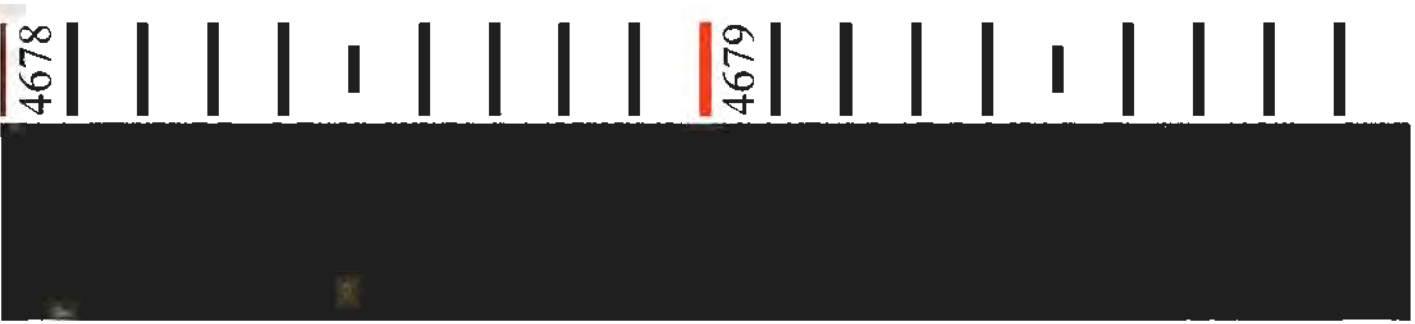

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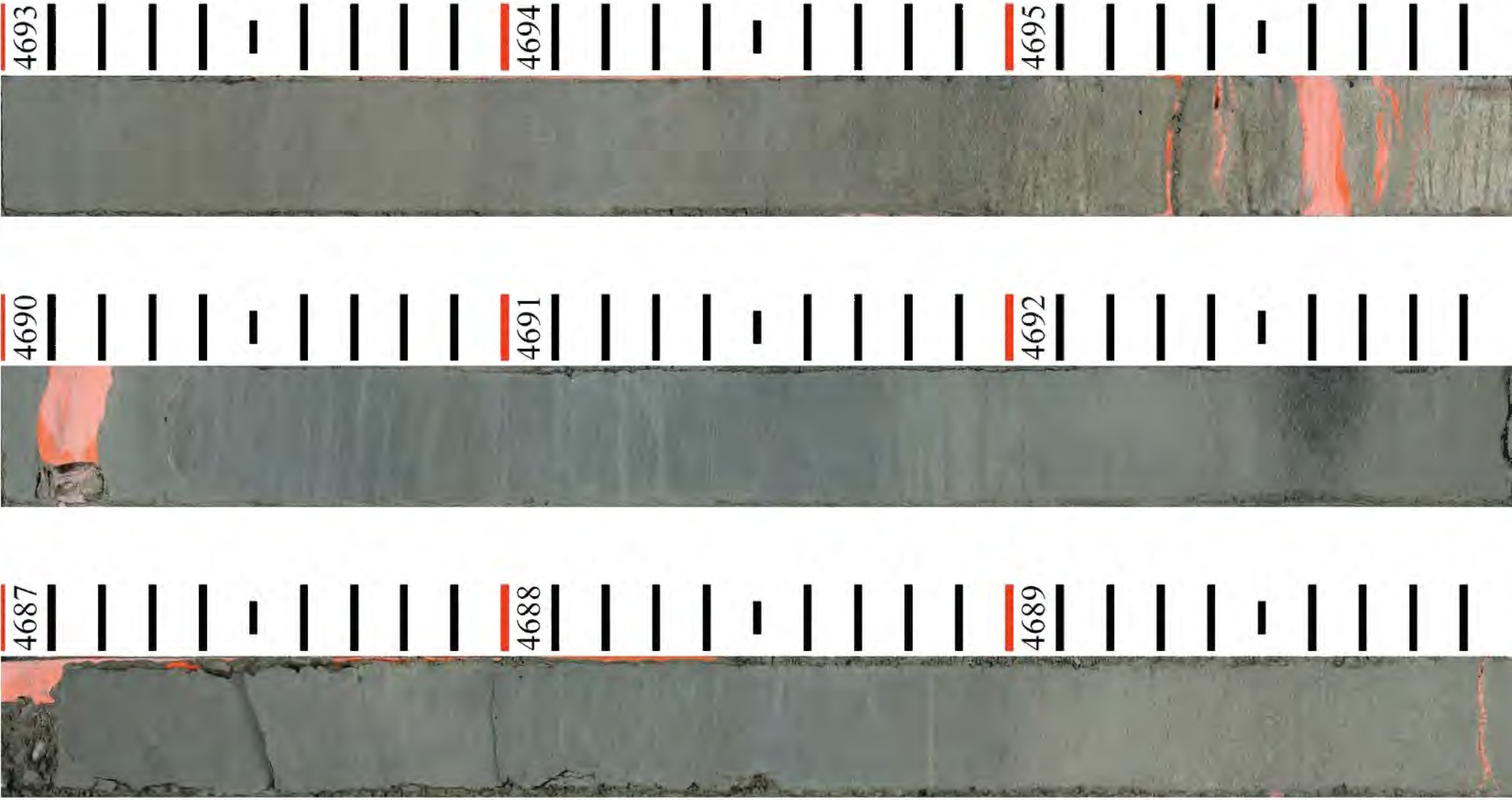

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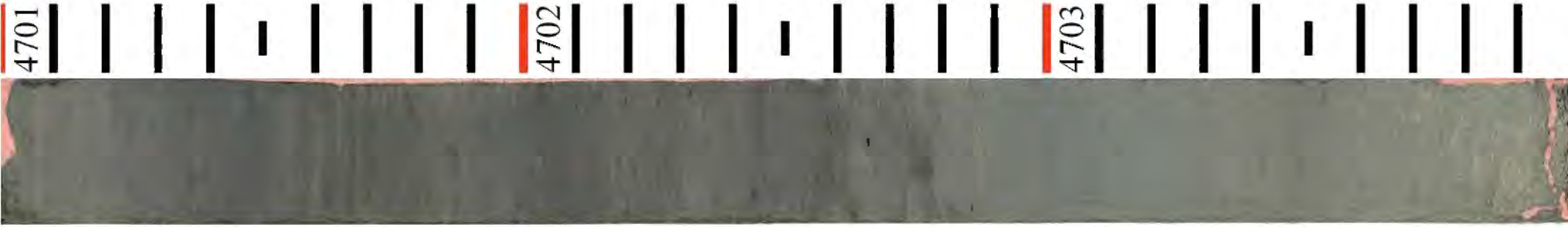

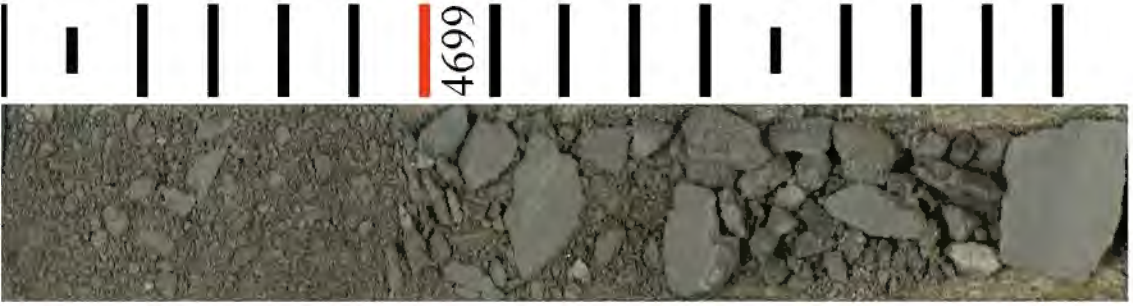



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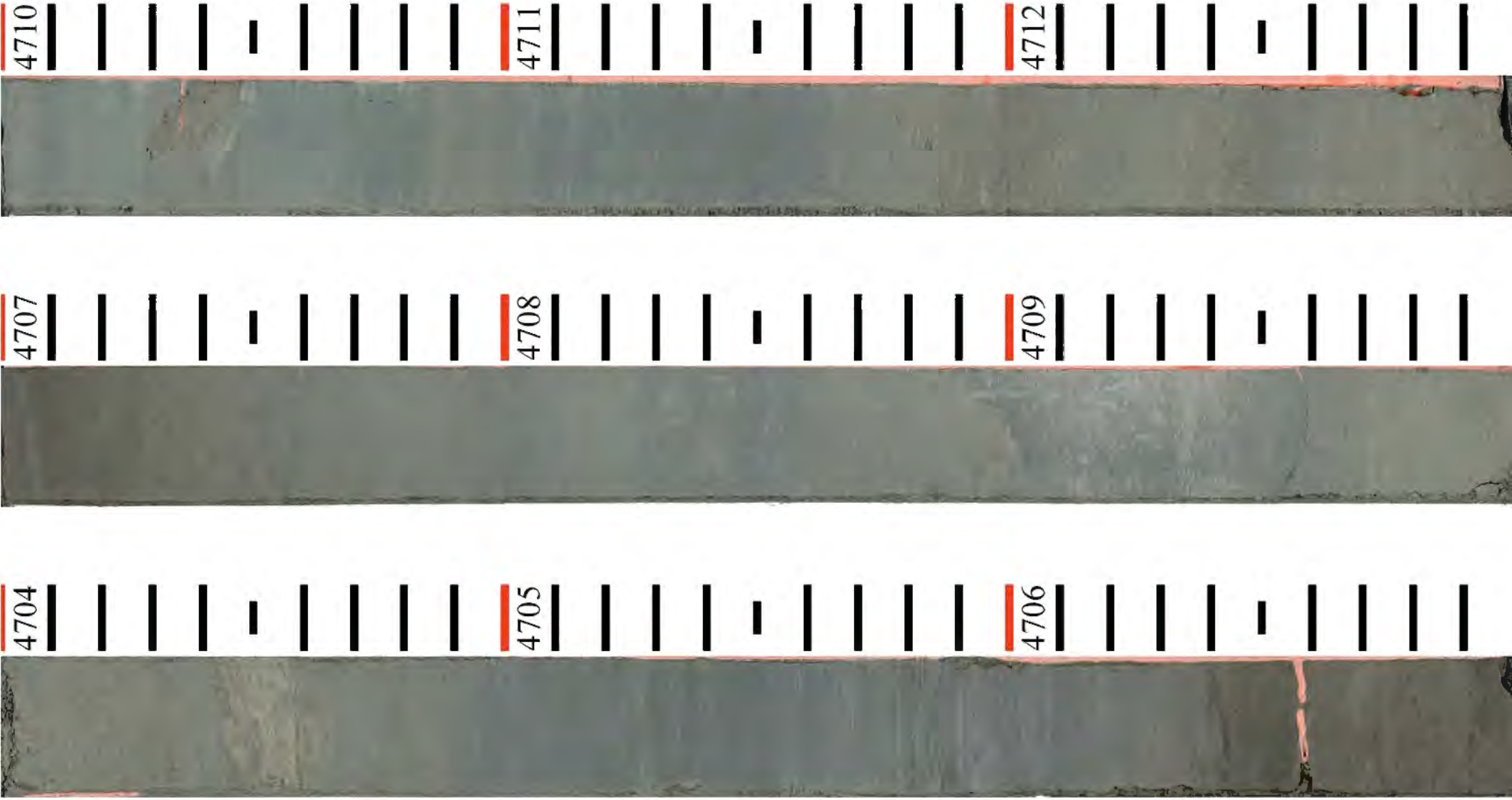

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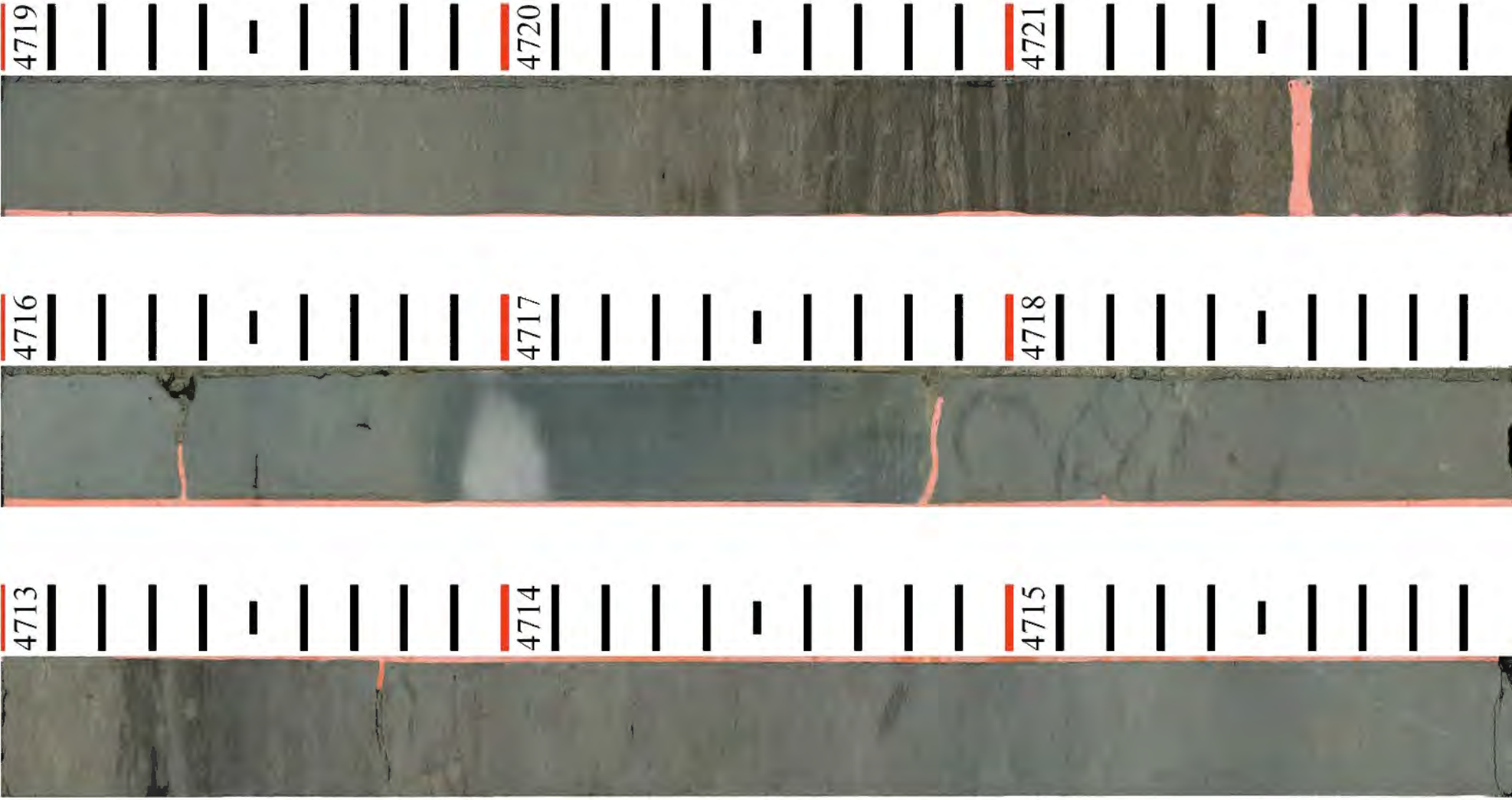

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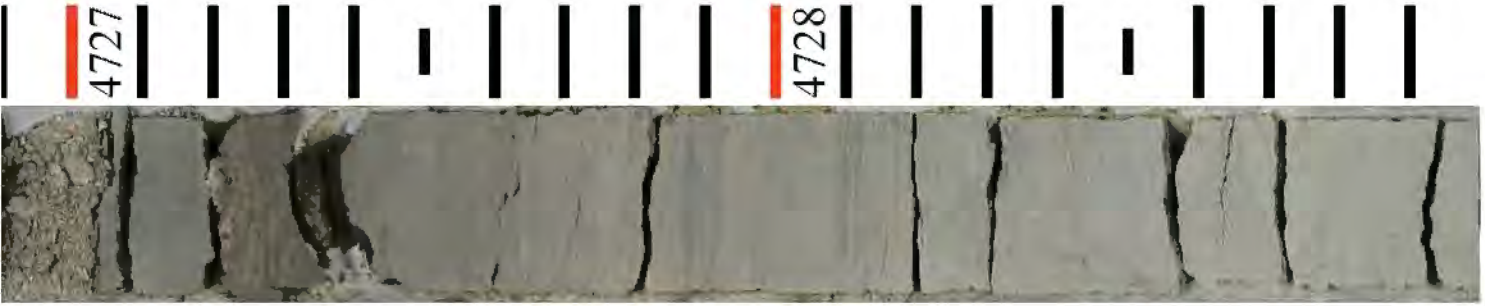





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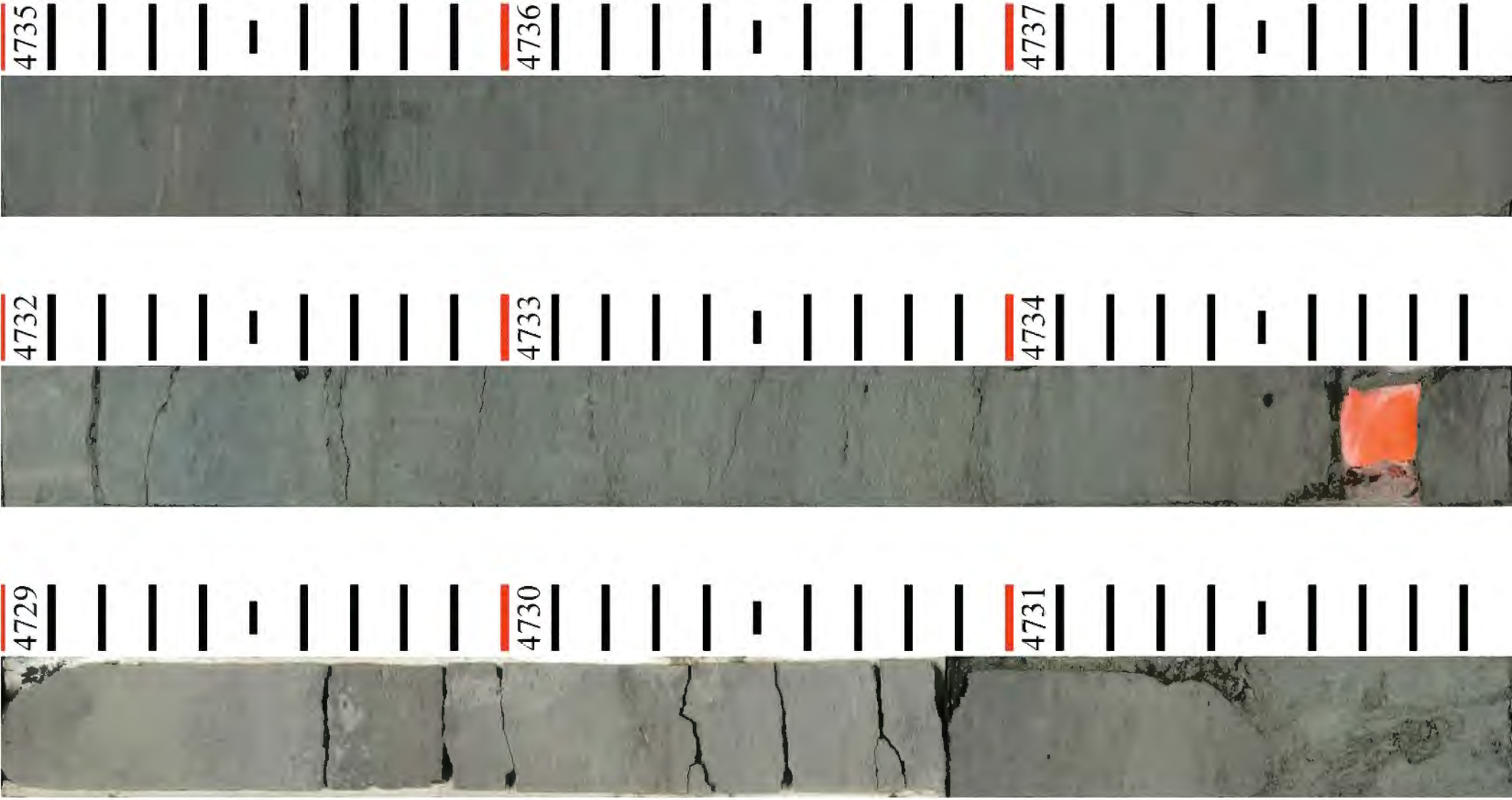

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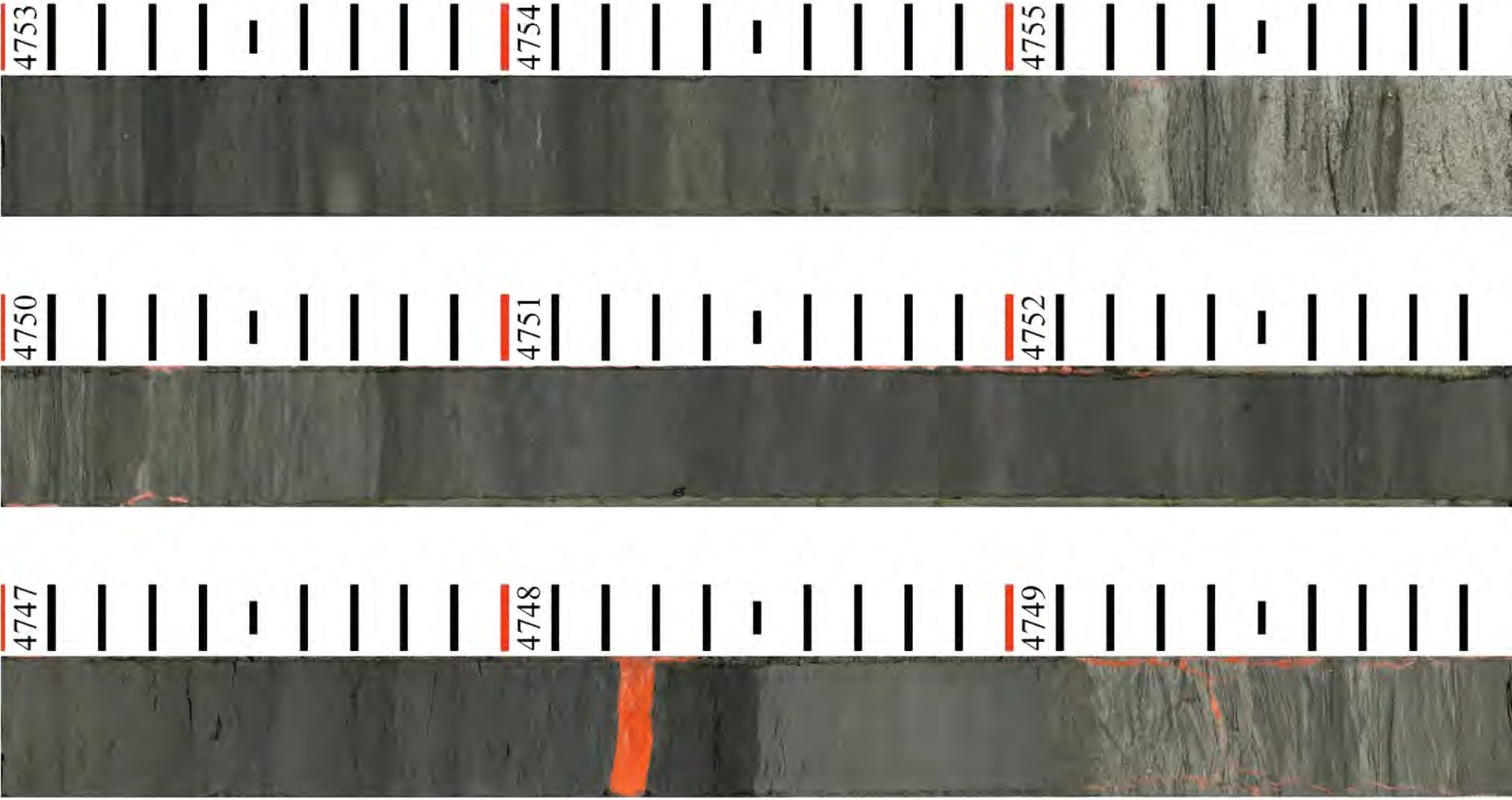

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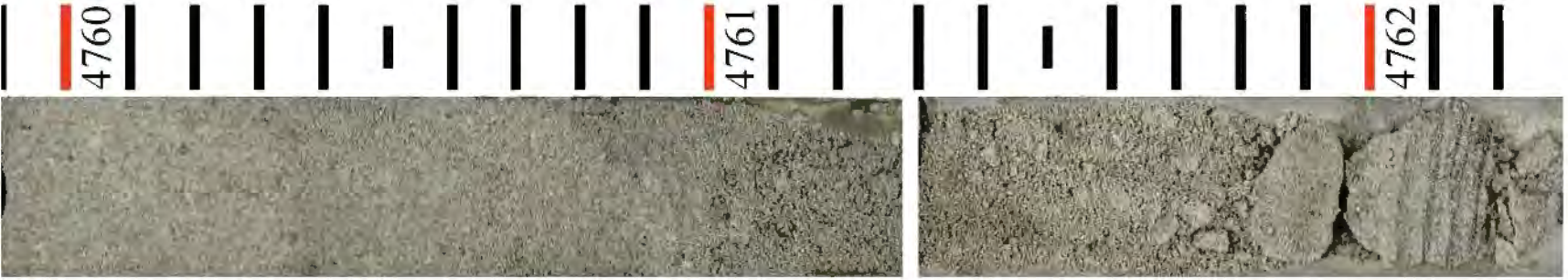
Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION





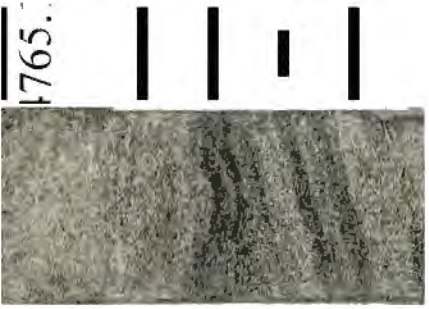


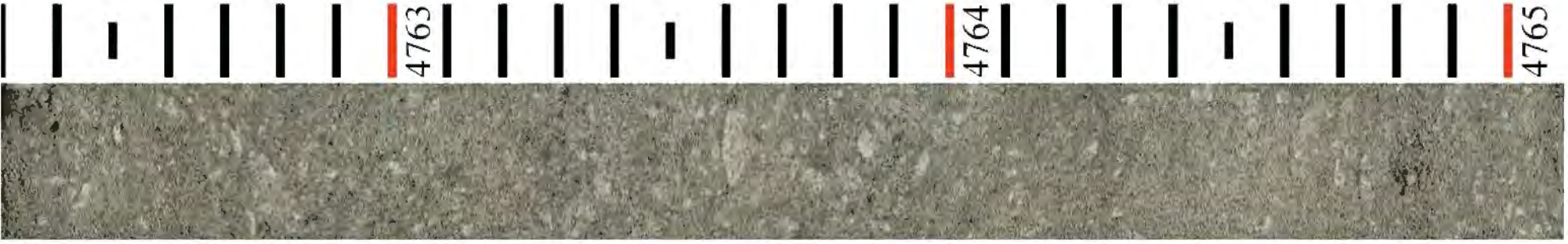
Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION







Pacific Gas and Electric Company®

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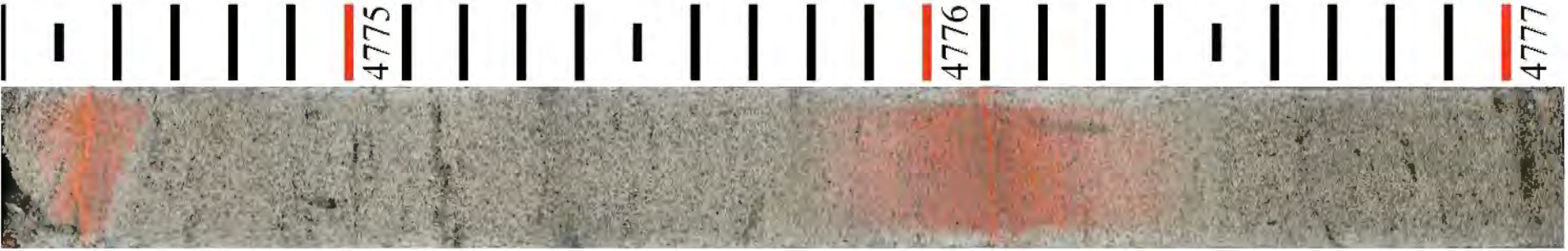
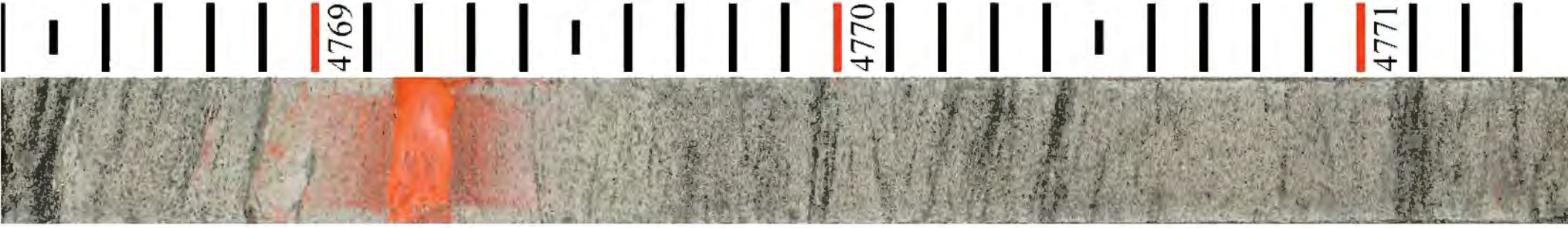
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION





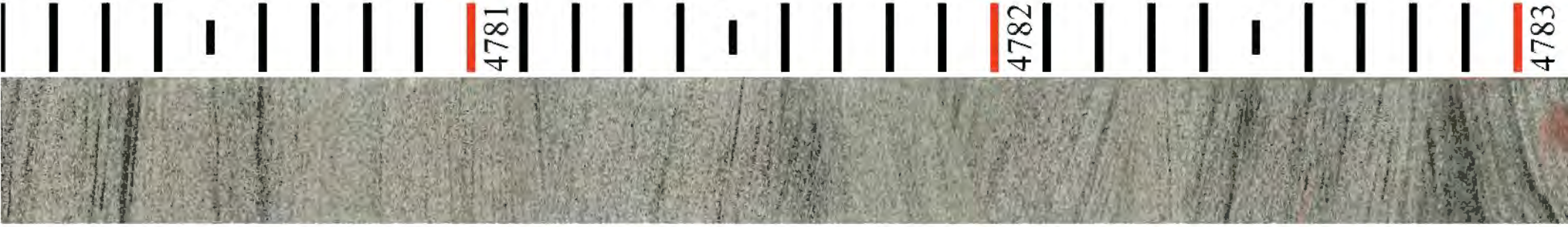


Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION



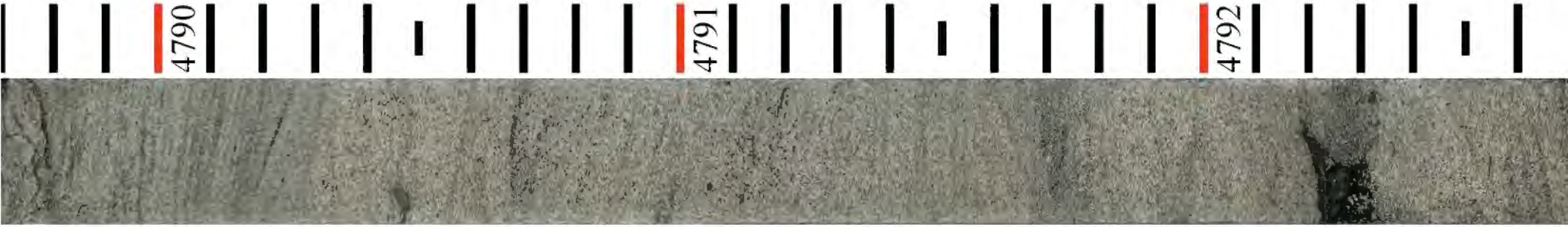


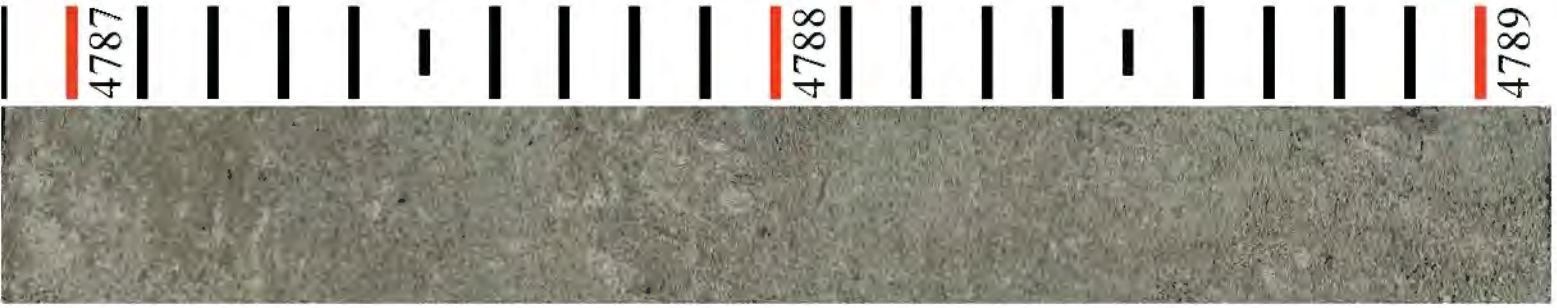


Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION



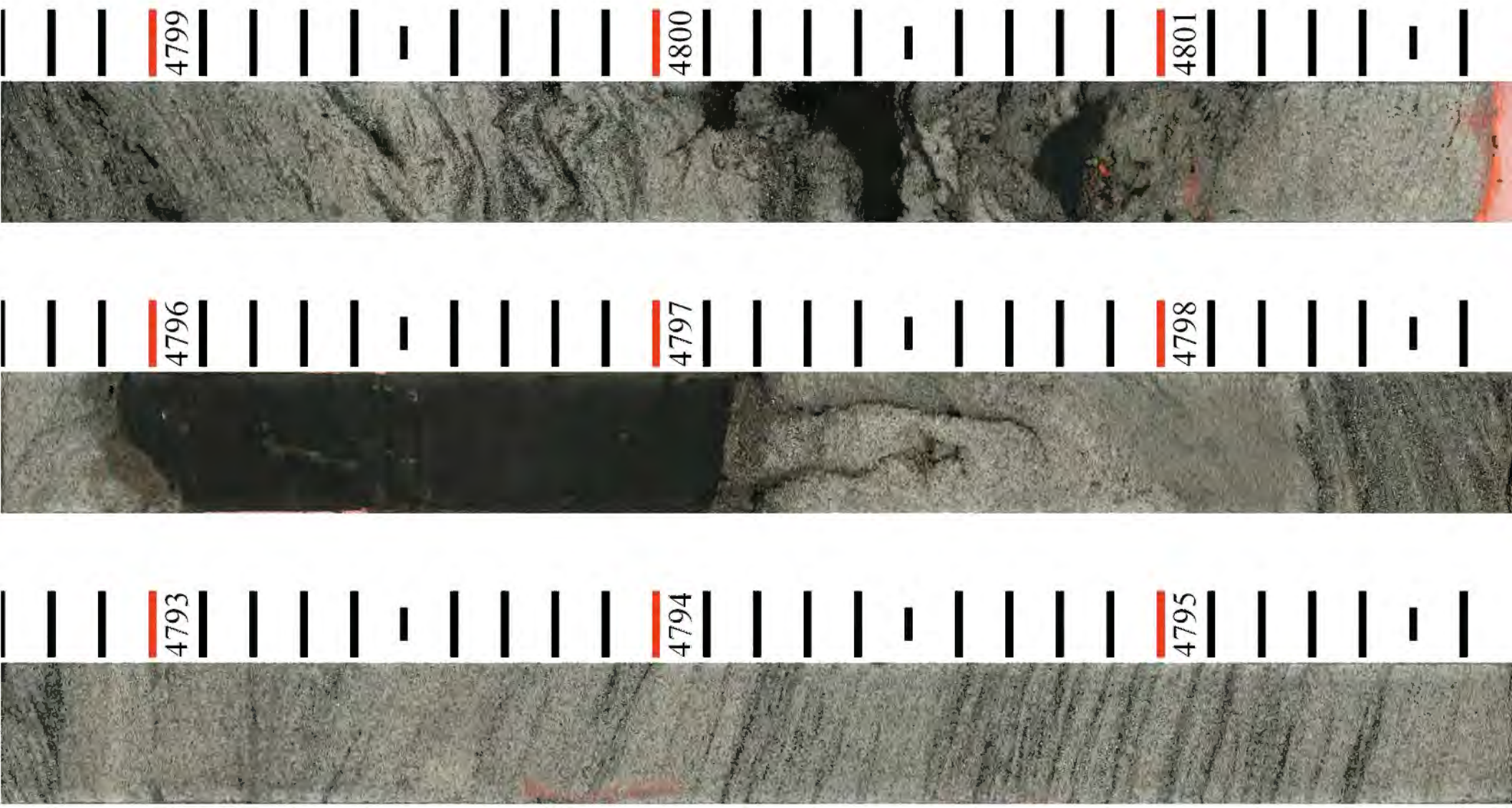




Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION



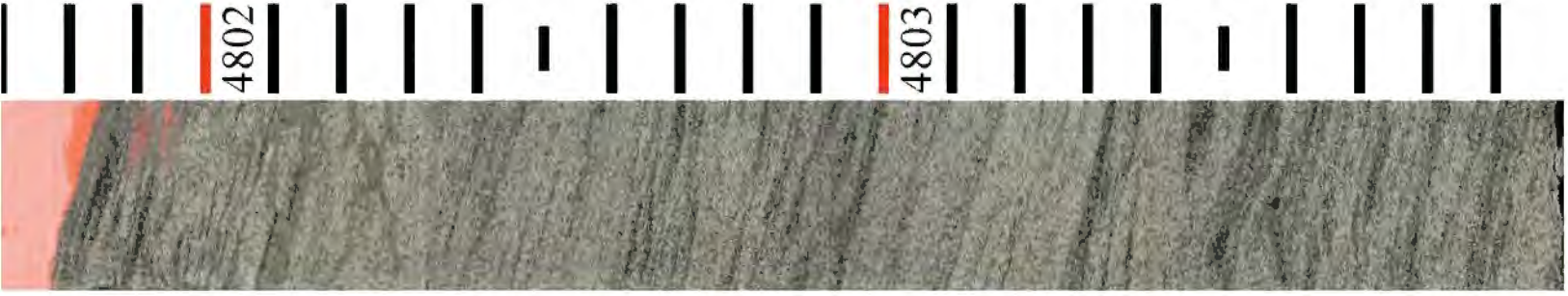
Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION





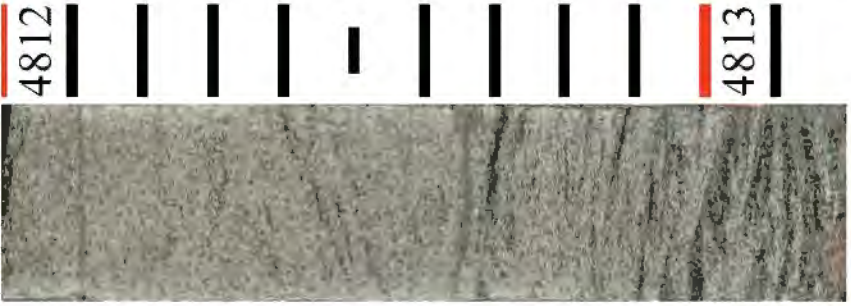


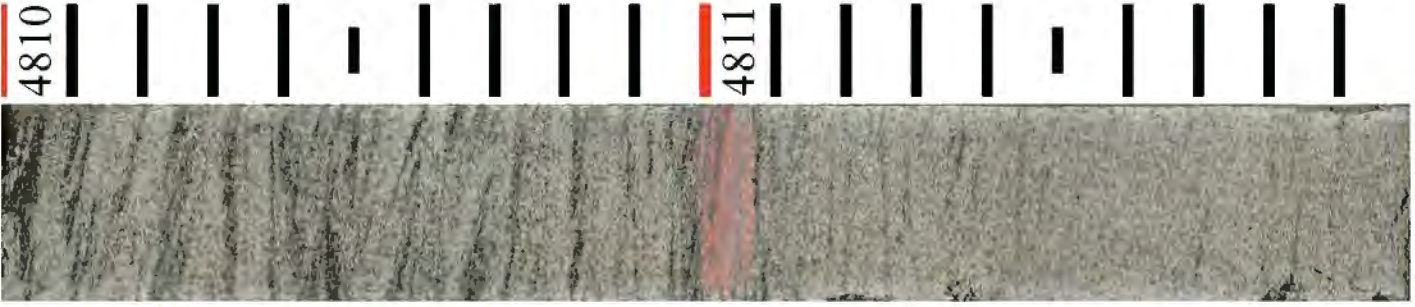
Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION







Pacific Gas and Electric Company®

Pacific Gas and Electric Company
WELL: Piacentine 2-27
FIELD: King Island

Core Lab
RESERVOIR OPTIMIZATION

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4641.17	0.0372	0.16	13.17	27.94	25.26
4641.33	0.0366	0.2	10.65	27.67	25.01
4641.5	0.0374	0.17	7.93	28.27	25.58
4641.67	0.0351	0.14	5.72	27.84	25.17
4641.83	0.0366	0.17	5.02	29.12	26.37
4642	0.0357	0.14	5.86	29.18	26.43
4642.17	0.0345	0.17	5.38	29.77	26.98
4642.33	0.0314	0.12	6.25	29.99	27.19
4642.5	0.0333	0.18	6.93	30.82	27.97
4642.67	0.0272	0.2	9.81	32.14	29.22
4642.83	0.0277	0.61	7.21	33.43	30.42
4643	0.0312	0.19	6.51	34.29	31.24
4643.17	0.0306	0.19	8.34	35.35	32.23
4643.33	0.0288	0.12	7.9	36.52	33.33
4643.5	0.0286	0.18	12.26	39.85	36.46
4643.67	0.0263	0.16	15.42	42.37	38.83
4643.83	0.0294	0.18	18.34	48.9	44.96
4644	0.0313	0.19	19.12	54.05	49.81
4644.17	0.0372	0.18	18.31	61.04	56.38
4644.33	0.0379	0.19	21.32	65.58	60.64
4644.5	0.0398	0.1	22.58	69.12	63.98
4644.67	0.0394	1.68	22.34	73.29	67.89
4644.83	0.0449	1.29	21.34	76.03	70.46
4645	0.0415	2.05	22.05	75.94	70.39
4645.17	0.0379	2.95	22.39	76.54	70.95
4645.33	0.0398	3.33	19.43	76.89	71.28
4645.5	0.0415	0.15	24.19	79.17	73.42
4645.67	0.0439	0.71	21.13	78.07	72.39
4645.83	0.0462	3.02	19.54	78.23	72.53
4646	0.0451	3.77	19.13	74.59	69.11
4646.17	0.0408	3.23	20.84	71.38	66.1
4646.33	0.0358	2.33	20.73	66.2	61.23
4646.5	0.0363	1.54	18.44	63.27	58.48
4646.67	0.0371	2.81	15.92	63.39	58.58
4646.83	0.0387	2.59	12.28	61.35	56.67
4647	0.0407	2.75	9.33	60.73	56.09
4647.17	0.0425	0.36	9.36	60.93	56.27
4647.33	0.04	1.78	7.97	61.02	56.36
4647.5	0.0393	2.14	9.18	62.02	57.3
4647.67	0.038	5.16	7.11	61.37	53.7
4647.67	0.038	5.16	7.11	61.37	53.7
4647.83	0.0363	4.42	7.46	61.5	55.89
4648	0.0332	5.2	5.75	60.62	52.83
4648.17	0.0337	3.98	5.04	60.79	56.14
4648.33	0.0338	2.78	3.22	59.43	54.87
4648.5	0.0298	5.42	3.05	59.6	51.21
4648.67	0.0279	6.76	2.37	59.44	47.28
4648.83	0.0273	7.12	2.03	57.57	44.43
4649	0.0263	6.79	3.32	57	44.79

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4649.17	0.0224	7.16	3.37	54.48	41.25
4649.33	0.0212	7.32	3.49	52.14	38.5
4649.5	0.0218	6.4	4.67	51.6	40.54
4649.67	0.0223	7.34	4.52	50.48	36.79
4649.83	0.0198	6.63	3.78	49.7	38.01
4650	0.0187	8.93	1.68	48.71	30.57
4650.17	0.0248	7.55	1.48	49.23	34.96
4650.33	0.0244	8.47	4.52	48.65	31.82
4650.5	0.0251	9.47	4.73	49.3	29.62
4650.67	0.0291	6.14	9.21	50.25	39.92
4650.83	0.0321	5.82	8.5	51.4	41.98
4651	0.0323	4.94	10.11	52.91	45.94
4651.17	0.0334	3.42	10.13	53.4	49.19
4651.33	0.0312	5.39	10.57	55.56	47.3
4651.5	0.0336	7.35	10.09	59.31	45.49
4651.67	0.0346	6.32	10.17	61.16	50.24
4651.83	0.0318	5.25	12.15	62.53	54.58
4652	0.031	4.69	13.78	63.91	57.53
4652.17	0.03	4.76	16.2	65.94	59.34
4652.33	0.024	3.52	20.11	67.63	62.57
4652.5	0.0227	4.53	17.09	70.57	64.57
4652.67	0.0205	5.38	19.18	70.9	62.5
4652.83	0.0215	5.58	15.58	70.12	61.18
4653	0.019	6.04	15.44	68.48	58.25
4653.17	0.0201	5.53	14.6	65.81	57.03
4653.33	0.018	4.9	16.06	64.12	57.13
4653.5	0.0211	2.68	17.84	63.08	58.29
4653.67	0.0181	1.55	19.16	60.88	56.23
4653.83	0.0163	3.49	17.94	59.78	55.2
4654	0.0165	3.5	17.92	59.02	54.48
4654.17	0.0179	3.4	16.61	57.79	53.32
4654.33	0.0211	0.58	14.58	56.35	51.97
4654.5	0.0221	0.68	13.3	53.88	49.65
4654.67	0.0218	0.38	12.98	51.15	47.08
4654.83	0.0225	2.49	9.99	50.43	46.4
4655	0.0204	4.04	7.77	49.54	45.13
4655.17	0.0211	3.57	7.35	49.65	45.68
4655.33	0.0181	3.73	8.46	49.71	45.72
4655.5	0.0164	5.88	6.91	48.97	39.4
4655.67	0.0156	7.02	5.41	48.89	36.12
4655.83	0.0167	5.78	6.09	50.02	40.72
4656	0.0176	3.87	8.08	50.52	46.49
4656.17	0.017	4	7.76	50.31	46.01
4656.33	0.0194	2.39	8.02	50.6	46.57
4656.5	0.0162	3.72	7.89	50.38	46.35
4656.67	0.0166	4.1	8.57	51.39	46.8
4656.83	0.0155	4.93	8.62	50.2	43.28
4657	0.0161	3.84	8.66	51.04	46.98
4657.17	0.0181	4.18	8.38	51.89	47.04

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4657.33	0.0165	4.46	12.4	52.88	47.24
4657.5	0.0154	4.56	11.82	53.31	47.39
4657.67	0.0176	3.47	14	57.38	52.93
4657.83	0.0192	2.71	14.59	57.56	53.11
4658	0.0213	3.51	12.72	57.64	53.18
4658.17	0.02	5.43	9.61	57.4	48.99
4658.33	0.0226	5.94	10.02	58.75	48.91
4658.5	0.019	6.75	11.13	58.6	46.48
4658.67	0.0184	4.99	14.85	59.93	52.75
4658.83	0.0189	5.62	12.8	58.38	49.43
4659	0.0189	4.58	16.36	60	53.95
4659.17	0.0181	2.07	19.79	59.68	55.1
4659.33	0.0132	1	22.78	59.67	55.09
4659.5	0.013	0.14	20.41	58.53	54.02
4659.67	0.0139	0.14	21.67	60.32	55.7
4659.83	0.0123	0.68	21.35	59.13	54.59
4660	0.0118	0.15	22.25	59.69	55.11
4660.17	0.0125	0.19	23.79	60.04	55.44
4660.33	0.0179	0.2	25.1	60.71	56.07
4660.5	0.0187	0.13	22.26	60	55.4
4660.67	0.0209	0.17	21.63	61.06	56.39
4660.83	0.025	0.19	20.78	60.36	55.74
4661	0.0262	0.13	22.42	61.25	56.58
4661.17	0.0266	0.18	19.7	60.13	55.52
4661.33	0.0309	0.16	16.79	60.27	55.65
4661.5	0.0336	0.1	16.61	59.49	54.92
4661.67	0.035	0.11	19.45	59.93	55.33
4661.83	0.0369	0.13	16.61	56.86	52.45
4662	0.0383	0.12	15.77	55.51	51.18
4662.17	0.0377	0.1	16.31	53.31	49.12
4662.33	0.0373	0.11	16.75	50.03	46.03
4662.5	0.0336	0.17	16.1	48.13	44.24
4662.67	0.0324	0.19	18.15	47.8	43.93
4662.83	0.033	0.19	18.41	46.09	42.33
4663	0.0306	0.14	17.48	45.03	41.33
4663.17	0.029	0.11	17.23	43.63	40.01
4663.33	0.0315	0.12	17.28	42.85	39.28
4663.5	0.0263	0.18	19.04	40.19	36.78
4666.17	0.0254	0.15	18.27	61.02	56.36
4666.33	0.0295	0.19	15.53	62.2	57.46
4666.5	0.0262	0.18	18.83	61.56	56.86
4666.67	0.0253	0.18	17.23	63.1	58.32
4666.83	0.0264	0.14	18.37	62.2	57.47
4667	0.0274	0.14	16.72	61.19	56.52
4667.17	0.0271	0.15	15.36	61.07	56.4
4667.33	0.0257	2.06	10.01	62.17	57.44
4667.5	0.0225	2.54	10.33	61.48	56.79
4667.67	0.0193	2.92	11.44	61.87	57.16

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4667.83	0.0227	1.72	12.32	61.78	57.07
4668	0.0185	3.82	10.3	60.59	55.96
4668.17	0.0209	4.75	9.15	59.83	53.31
4668.33	0.0214	1.49	8.65	59.38	54.82
4668.5	0.0191	2.27	10.38	57.35	52.91
4668.67	0.02	3.11	9.42	57.04	52.61
4668.83	0.0218	0.63	11.49	55.65	51.31
4669	0.0205	2	9.19	55.62	51.28
4669.17	0.0199	0.95	10.47	57.18	52.75
4669.33	0.0198	0.1	13.29	56.68	52.28
4669.5	0.0201	0.16	15.52	56.27	51.89
4669.67	0.0218	0.29	16.85	56.65	52.25
4669.83	0.0272	0.19	17.48	55.84	51.49
4670	0.0262	0.13	16	55.9	51.55
4670.17	0.0263	0.16	16.43	54.82	50.53
4670.33	0.0224	0.19	15.33	53.99	49.75
4670.5	0.023	0.81	16.66	52.96	48.78
4670.67	0.0217	0.96	16.5	53.39	49.19
4670.83	0.0233	0.17	15.66	52.36	48.22
4671	0.0217	0.18	15.48	51.38	47.29
4671.17	0.0165	1.56	17.33	50.62	46.58
4671.33	0.0152	1.62	15.55	49.01	45.07
4671.5	0.0149	2.03	12.46	48.21	44.32
4671.67	0.0169	0.14	12.49	48.98	45.04
4671.83	0.0169	0.17	12.47	48.63	44.71
4672	0.0156	1.98	8.93	47.96	44.09
4672.17	0.0133	3.15	10.23	48.91	44.97
4672.33	0.0136	2.54	9.11	51.3	47.22
4672.5	0.0167	3.82	9.77	52.47	48.32
4672.67	0.0164	2.82	10.79	54.53	50.26
4672.67	0.0164	2.82	10.79	54.53	50.26
4672.83	0.019	0.91	9.44	54.04	49.8
4673	0.019	0.99	11.36	54.23	49.97
4673.17	0.0202	2.08	10.33	54.88	50.58
4673.33	0.025	0.15	9.72	55.95	51.59
4673.5	0.0256	0.19	10.69	55.5	51.17
4673.67	0.0276	0.15	15.61	56.85	52.44
4673.83	0.0271	0.15	18.04	55.99	51.63
4674	0.0288	0.13	16.83	54.79	50.5
4674.17	0.0317	0.15	20.35	55.5	51.17
4674.33	0.0316	0.1	21.54	54.6	50.32
4674.5	0.0326	0.17	23.33	52.73	48.57
4674.67	0.0293	0.11	21.78	50.9	46.85
4674.83	0.0293	0.17	18	50.69	46.65
4675	0.0296	0.12	18.7	50.03	46.03
4675.17	0.0297	0.17	16.55	51.67	47.57
4675.33	0.0299	0.11	15.82	51.56	47.46
4675.5	0.0335	0.16	13.83	51.77	47.67
4675.67	0.0338	0.15	14.19	52.55	48.4

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4675.83	0.0341	0.19	10.99	52.1	47.97
4676	0.0352	0.13	8.11	52.34	48.2
4676.17	0.0343	0.14	8.48	54.41	50.14
4676.33	0.0323	2.01	7.7	53.84	49.61
4676.5	0.0359	0.1	5.67	55.22	50.91
4676.67	0.0379	0.19	7.18	56.14	51.77
4676.83	0.0394	0.13	8.84	57.38	52.94
4677	0.0397	0.2	7.49	55.78	51.43
4677.17	0.0393	0.2	6.72	58.28	53.78
4677.33	0.0379	1.6	5.55	58.06	53.58
4677.5	0.038	3.42	5.36	57.78	53.32
4677.67	0.0338	4.66	8.04	58.87	52.62
4677.83	0.0346	4.09	8.39	59.16	54.51
4678	0.0336	4.25	8.49	59.86	54.74
4678.17	0.0341	3.62	10.03	59.85	55.26
4678.33	0.0314	3.47	10.03	58.3	53.8
4678.5	0.0305	1.43	10.73	58.61	54.1
4678.67	0.0304	2.5	11.7	57.44	52.99
4678.83	0.0269	5.28	10.69	58.19	50.21
4679	0.028	3.36	11.13	58.55	54.04
4679.17	0.0315	2.59	13.11	59.43	54.87
4679.33	0.0328	2.02	16.09	59.01	54.47
4679.5	0.0378	0.16	17.25	60.62	55.98
4679.67	0.0403	0.18	16.77	61.73	57.03
4679.83	0.0437	0.11	15.44	60.53	55.89
4680	0.0424	0.12	15.08	60.02	55.42
4680.17	0.0398	0.73	13.08	60.63	55.99
4680.33	0.0415	0.17	13.59	60.38	55.75
4680.5	0.0443	0.16	14.85	61.49	56.8
4680.67	0.0445	0.13	14.96	62.01	57.29
4680.83	0.0407	0.68	15.73	61.38	56.69
4681	0.0424	0.17	16.81	60.53	55.9
4681.17	0.0422	0.18	17.65	59.09	54.55
4681.33	0.0368	0.1	18.31	58.5	53.99
4681.5	0.0353	0.18	15.44	57.75	53.28
4681.67	0.0303	0.45	14.46	54.49	50.22
4681.83	0.0259	2.15	14.43	52.62	48.46
4682	0.0221	4.7	15.01	51.42	45.14
4682.17	0.0193	5.21	15.29	51.04	43.33
4682.33	0.0171	3.27	17.28	48.44	44.53
4682.5	0.013	6.87	15.45	46.02	33.7
4682.67	0.0103	7.37	14.18	42.86	29.17
4682.83	0.0069	5.63	15.14	38.97	30.2
4683	0.0082	7.03	11.76	34.87	22.19
4683.17	0.0062	7.74	10	31.98	17.35
4683.33	0.0052	8.51	8.12	30.03	13.26
4683.5	0.007	6.64	7.27	26.97	15.48
4683.67	0.0041	6.66	7.92	24.91	13.37
4683.83	0.003	7.49	8.08	23.66	9.82

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4684	0.002	7.18	9.37	22.05	9.1
4684.17	0.0018	5.54	8.72	19.77	11.44
4684.33	0.0043	3.74	8.19	16.51	13.26
4684.5	0.0085	1.82	6.64	13.51	11.69
4687.17	0.0143	13.96	19.88	80.97	48.38
4687.33	0.0159	15.02	15.82	78.75	43.2
4687.5	0.0153	15.48	19.58	80.96	44.1
4687.67	0.0178	13.72	20.95	80.74	48.81
4687.83	0.0158	10.97	22.68	79.38	55.21
4688	0.0178	10.84	21.81	78.41	54.6
4688.17	0.0191	9.64	21.61	76.83	56.4
4688.33	0.0213	10.17	20.91	75.42	53.52
4688.5	0.0237	11.47	16.26	73.36	47.84
4688.67	0.0233	8.27	19.41	71.03	54.51
4688.83	0.0229	5.48	20.04	66.38	57.76
4689	0.0189	7.01	17.28	63.73	50.84
4689.17	0.0254	4.68	15.2	61.31	54.98
4689.33	0.0264	5.12	13.11	59.39	51.86
4689.5	0.0284	3.42	13.05	59.14	54.59
4689.67	0.0325	2.79	8.38	58.39	53.89
4689.83	0.031	5	7.19	59.24	52.02
4690	0.0341	7.25	2.37	60.26	46.74
4690.17	0.0328	7.05	1.77	60.77	47.8
4690.33	0.0333	7.86	0.87	61.76	46.5
4690.5	0.0332	6.47	1.28	63.2	51.83
4690.67	0.0344	7.41	2.19	66.47	52.42
4690.83	0.0339	11.06	0.1	70.28	45.93
4691	0.0327	9.99	2.05	72.89	51.53
4691.17	0.0354	10.16	1.72	73.94	52.11
4691.33	0.0336	11.59	2.94	74.54	48.67
4691.5	0.0317	12.11	4.27	75.69	48.34
4691.67	0.0293	11.69	5.75	75.53	49.37
4691.83	0.0248	12.32	6.22	73.55	45.65
4692	0.0281	8.15	5.86	71.65	55.48
4692.17	0.0265	9.25	8.71	71.19	51.92
4692.33	0.0285	10.11	8.78	72.28	50.58
4692.5	0.0257	10.94	6.71	71.33	47.32
4692.67	0.0254	12.06	4.83	70.76	43.6
4692.83	0.0218	10.15	6.22	69.56	47.8
4693	0.0235	8.47	9.26	68.61	51.56
4693.17	0.0241	10.43	8.23	68.03	45.49
4693.33	0.0228	10.8	8.34	68.12	44.54
4693.5	0.0225	8.63	9.36	67.41	49.91
4693.67	0.027	7.61	9.33	67.09	52.48
4693.67	0.027	7.61	9.33	67.09	52.48
4693.83	0.0272	6.67	10.55	67.53	55.54
4694	0.03	5.55	10.38	66.51	57.69
4694.17	0.0292	7.33	11.83	66.42	52.59

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4694.33	0.0312	5.83	12.05	65.48	55.87
4694.5	0.0279	3.99	13.78	63.73	58.91
4694.67	0.0295	3.5	15.56	62.44	57.69
4694.83	0.0311	2.93	16.98	61.16	56.49
4695	0.0327	1.59	14.99	58.78	54.26
4695.17	0.0348	1.65	12.81	57.51	53.06
4695.33	0.0373	0.14	11.94	55.25	50.93
4695.5	0.0402	0.16	11.08	53.85	49.62
4695.67	0.0376	0.21	11.08	54.05	49.81
4695.83	0.0323	0.11	11.72	52.62	48.47
4696	0.0314	3.2	10.83	52.96	48.78
4696.17	0.0295	3.6	11.73	53.71	49.49
4696.33	0.0287	5.27	8.2	52.58	44.68
4696.5	0.0303	6.55	6.72	52.88	41.39
4696.67	0.0317	10.7	4.61	52.7	29.55
4696.83	0.031	10.71	5.07	55.61	32.4
4697	0.0307	8.61	6.47	57.43	40.11
4697.17	0.0264	8.51	12.38	60.4	43.31
4697.33	0.0223	8.61	13.62	61.17	43.81
4697.5	0.0205	9.54	16.06	63.47	43.46
4697.67	0.0163	9.04	20.84	64.51	45.9
4697.83	0.0189	5.86	21.24	62.46	52.79
4698	0.0223	6.87	19.64	62.95	50.47
4698.17	0.0239	4.67	19.98	62.02	55.71
4698.33	0.0252	5.08	19.02	61.59	54.13
4698.5	0.0227	2.93	24.14	61.85	57.14
4698.67	0.0221	1.7	23.96	61.55	56.85
4698.83	0.0192	0.59	22.87	59.31	54.75
4699	0.0189	0.17	24.11	56.17	51.8
4699.17	0.0175	0.15	24.07	55.16	50.85
4699.33	0.0206	1.89	20.16	53.12	48.93
4699.5	0.0224	1.06	20.53	51.73	47.62
4699.67	0.0213	1.44	16.77	49.27	45.32
4699.83	0.0242	4.39	11.34	48.63	43.25
4700	0.0243	5.68	9.31	49.93	40.9
4701.17	0.0131	13.07	10.86	89.73	58
4701.33	0.0097	15.25	11.18	88.09	49.92
4701.5	0.0074	16.81	10.32	86.74	43.95
4701.67	0.0096	14.6	11.48	85.91	49.69
4701.83	0.0117	11.01	14.61	84.52	58.94
4702	0.0115	9.75	15.07	82.57	60.76
4702.17	0.0122	9.24	14.19	81.38	61.09
4702.33	0.0144	9.83	14.21	79.31	57.27
4702.5	0.0171	7.16	14.21	76.23	62.14
4702.67	0.0173	6.4	13.43	73.64	61.82
4702.83	0.0162	4.08	11.39	70	64.8
4703	0.0132	1.92	13.4	66.53	61.54
4703.17	0.0115	1.59	11.81	61.14	56.47
4703.33	0.0146	0.18	11.47	58.56	54.05

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4703.5	0.0176	0.14	11.05	58.74	54.22
4703.67	0.0201	0.18	12.18	59.28	54.72
4703.83	0.0188	0.17	12.03	58.91	54.37
4704	0.0176	0.14	9.55	60.05	55.45
4704.17	0.0178	0.19	9.15	62.55	57.8
4704.33	0.0168	0.18	11.19	64.58	59.7
4704.5	0.019	0.38	8.93	67.46	62.42
4704.67	0.0199	3	6.49	71.26	65.98
4704.83	0.0202	4.92	4.47	75.84	68.38
4705	0.0185	5.88	7.71	79.42	69.1
4705.17	0.0161	8.93	8.79	82.8	63.41
4705.33	0.0172	9.59	11.6	87.42	66.01
4705.5	0.0167	10.86	13.15	89.51	64.35
4705.67	0.0168	12.28	13.85	91.17	61.75
4705.83	0.018	13.11	11.03	90.97	59.13
4706	0.0186	16.1	9.45	92.46	51.71
4706.17	0.0174	16.65	9.27	92.98	50.62
4706.33	0.0188	15.68	9.4	91.6	52.12
4706.5	0.0194	15.13	8.19	90.57	52.73
4706.67	0.0193	13.12	9.73	90.54	58.66
4706.83	0.0207	10.7	10.69	89.69	65
4707	0.0223	8.87	12.69	88.6	69.32
4707.17	0.0197	10.69	14.59	88.82	64.15
4707.33	0.0257	10.35	13.64	89.45	65.79
4707.5	0.0239	11.89	11.28	88.37	60.16
4707.67	0.0236	10.21	8.75	88.52	65.26
4707.67	0.0236	10.21	8.75	88.52	65.26
4707.83	0.0243	9.15	8.64	87.15	67.06
4708	0.0197	11.86	10.89	86.81	58.7
4708.17	0.0179	9.95	13.02	84.41	61.98
4708.33	0.0199	9.83	9.34	83.01	60.94
4708.5	0.0189	11.52	7.6	81.95	54.89
4708.67	0.0183	13.1	6.55	80.22	48.49
4708.83	0.0174	12	7.09	78.14	49.69
4709	0.0133	11.93	8.86	76.29	48.06
4709.17	0.0111	12.97	9.56	74.7	43.42
4709.33	0.0157	10.4	5.88	72.78	49.13
4709.5	0.0154	6.14	7.12	70.66	59.67
4709.67	0.0138	7.03	8.11	69.48	55.84
4709.83	0.0123	8.92	9.52	67.23	48.03
4710	0.0104	9.5	8.32	65.13	44.22
4710.17	0.0119	7.53	8.42	64.16	49.09
4710.33	0.013	9.47	7.47	65.45	44.64
4710.5	0.0107	8.45	9.33	65.35	47.56
4710.67	0.011	6.94	11.19	66.65	53.3
4710.83	0.011	5.38	12.7	65.77	57.07
4711	0.0113	4.24	12.29	65.69	60.35
4711.17	0.0155	4.63	11.24	65.58	59.09
4711.33	0.0151	3.78	9.86	61.98	57.27

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4711.5	0.0165	3.76	8.88	62.1	57.38
4711.67	0.0134	7.6	6.32	60.01	44.79
4711.83	0.0183	3.26	4.13	58.31	53.81
4712	0.0167	2.33	4.76	57.98	53.5
4712.17	0.0171	1.16	7.34	57.23	52.79
4712.33	0.0189	0.13	5.96	58.76	54.24
4712.5	0.0195	0.13	7.01	56.34	51.96
4712.67	0.021	0.14	7.52	55.64	51.3
4712.83	0.0216	0.1	6.64	54.83	50.54
4713	0.0198	2.84	3.52	55.15	50.84
4713.17	0.0175	4.76	4.24	55	48.25
4713.33	0.0154	4.04	5.14	55.77	51.15
4713.5	0.0159	3.75	6.17	56.61	52.21
4713.67	0.0144	3.67	6.41	54.46	50.19
4713.83	0.0156	4.61	6.2	55.56	49.24
4714	0.0123	6.75	9.31	55.67	42.99
4714.17	0.011	9.08	7.89	54.45	34.88
4714.33	0.0126	11.06	4.66	54.66	29.24
4714.5	0.013	10.61	6.1	51.39	27.33
4714.67	0.0158	9.76	3.06	51.65	30.11
4714.83	0.0145	7.88	6.29	50.29	34.33
4715	0.0139	6.22	5.66	47.93	36.92
4715.17	0.0148	4.72	8.91	47.08	40.5
4715.33	0.0148	6.28	7.39	45.98	34.79
4715.5	0.0147	4.62	7.99	42.77	36.55
4715.67	0.0158	4.11	8.56	42.65	37.93
4715.83	0.0161	2.91	9.28	42.93	39.36
4716	0.0169	1.19	9.19	41.95	38.43
4716.17	0.0185	2.25	6.3	41.79	38.28
4716.33	0.0212	1.42	6.33	43.83	40.2
4716.5	0.0194	0.19	7.76	43.5	39.89
4716.67	0.0182	0.86	6.03	44.45	40.78
4716.83	0.0182	0.16	7.54	44.49	40.82
4717	0.0189	0.12	6.72	43.05	39.47
4717.17	0.017	0.18	7.37	42.99	39.41
4717.33	0.0174	0.13	3.94	42.13	38.6
4717.5	0.0196	0.16	4.76	40.71	37.27
4717.67	0.0186	0.18	3.4	41.63	38.13
4717.83	0.0164	0.17	3	42.34	38.8
4718	0.0145	0.16	5.51	42.67	39.11
4718.17	0.0168	0.19	5.59	43.48	39.87
4718.33	0.0161	0.16	6.07	43.6	39.98
4718.5	0.017	0.15	6.63	42.85	39.28
4718.67	0.0195	0.17	6.24	43.45	39.84
4718.83	0.0219	0.11	7.01	43.03	39.45
4719	0.0193	0.13	8.9	42.82	39.25
4719.17	0.02	0.16	8.36	45.72	41.97
4719.33	0.022	0.14	8.82	46.39	42.61
4719.5	0.0229	0.14	10.17	46.62	42.82

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4719.67	0.0216	0.11	11.12	47.48	43.63
4719.83	0.021	2.88	10.02	48.2	44.31
4720	0.0234	3.59	8.58	47.87	44
4720.17	0.0246	2.58	6.9	47.95	44.08
4720.33	0.0212	3.29	7.75	47.05	43.23
4720.5	0.0208	2.34	7.45	46.67	42.87
4720.67	0.0202	1.62	5.69	45.81	42.06
4720.83	0.0186	3.64	5.16	44.69	41.01
4721	0.0171	3.08	5.03	45.33	41.61
4721.17	0.0178	2.13	4.2	44.23	40.58
4721.33	0.0188	0.82	3.68	43.11	39.52
4721.5	0.0174	0.14	5.8	41.74	38.23
4721.67	0.0185	0.15	6.74	42.51	38.96
4721.83	0.0205	0.17	5.68	42.63	39.07
4722	0.0232	0.13	7.26	42.02	38.5
4722.17	0.0232	0.17	5.71	40.58	37.14
4722.33	0.0229	0.13	3.87	39.46	36.09
4722.5	0.0233	0.13	4.56	37.97	34.7
4722.67	0.0275	0.19	6.21	37.1	33.88
4722.83	0.0282	0.18	6.82	35.87	32.72
4723	0.0279	0.1	8.37	36.18	33.01
4723.17	0.0263	0.15	10.87	34.59	31.51
4723.33	0.0269	0.12	10.41	36.42	33.23
4723.5	0.026	0.12	9.41	36.06	32.89
4723.67	0.0265	0.18	5.93	37.17	33.94
4723.83	0.0276	0.15	5.05	37.66	34.4
4724	0.0238	0.15	4.89	37.67	34.41
4724.17	0.0207	0.15	4.52	37.96	34.68
4724.33	0.0216	0.15	6.25	39.12	35.77
4724.5	0.0222	0.2	6.88	39.73	36.34
4724.67	0.0245	0.18	6.92	42.71	39.15
4724.83	0.0198	3.08	5.35	45.95	42.19
4725	0.0187	2.27	8.15	49.4	45.44
4725.17	0.0168	4.9	5.8	51.41	44.26
4725.33	0.0197	4.47	4.2	52.18	46.3
4725.5	0.0188	6.57	3.94	54.03	41.91
4725.67	0.021	7.23	4.34	55.79	41.71
4725.83	0.0222	4.43	5.77	58.7	52.87
4726	0.0208	4.22	6.92	60.15	54.93
4726.17	0.0221	3.16	8.23	60.21	55.59
4726.33	0.0213	5.93	7.94	60.43	50.14
4726.5	0.0205	4.84	8.46	62.39	55.32
4726.67	0.0203	3.71	10	64.57	59.7
4726.83	0.0154	6.57	11.1	66.13	53.88
4727	0.0143	6.37	12.84	66.11	54.47
4727.17	0.0149	7.3	11.24	66.6	52.18
4727.33	0.018	4.9	13.03	68.22	60.92
4727.5	0.0178	5.6	13.43	71.34	61.92
4727.67	0.0174	5.97	13.11	70.05	59.56

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4727.83	0.0153	7.37	11.55	69.68	55.04
4728	0.0164	10.06	8.61	67.02	44.43
4728.17	0.0157	10.52	8.42	67.1	43.15
4728.33	0.0172	12.02	8.08	69.67	41.26
4728.5	0.0201	9.08	8.07	71.69	51.96
4728.67	0.0194	10.53	7.56	72.31	48.29
4728.83	0.02	12.61	5.48	72.93	42.75
4729	0.0251	11.02	2.2	71.78	46.3
4729.17	0.0172	12.07	26.42	88.86	60.1
4729.33	0.0178	11.95	22.92	84.36	55.99
4729.5	0.0174	11.11	19.82	81.7	55.87
4729.67	0.0177	8.39	21.15	81.44	63.64
4729.83	0.0173	8.34	19.22	78.46	60.85
4730	0.019	6.87	20.13	75.8	62.58
4730.17	0.0178	5.36	22.09	72.8	64.08
4730.33	0.0202	2.19	21.77	70.4	65.18
4730.5	0.022	0.17	20.43	66.55	61.55
4730.67	0.0212	1.61	16.77	62.73	57.97
4730.83	0.0229	1.28	15	60.45	55.82
4731	0.0208	2.35	13.91	56.38	52
4731.17	0.0218	0.18	14.19	53.85	49.62
4731.33	0.0222	0.17	13.33	52.56	48.4
4731.5	0.0207	0.18	15.05	53.66	49.44
4731.67	0.0201	0.19	17.03	55.09	50.78
4731.83	0.0197	0.16	16.34	51.83	47.72
4732	0.0223	0.19	17.85	52.57	48.42
4732.17	0.0209	0.1	16.56	52.91	48.73
4732.33	0.0224	0.18	15.59	55.32	51
4732.5	0.0219	0.17	15.27	54.83	50.54
4732.67	0.0222	0.11	15.94	54.25	49.99
4732.83	0.0224	0.16	18.2	56.18	51.81
4733	0.0207	0.18	18.16	55.21	50.89
4733.17	0.0201	0.12	16.64	57.68	53.22
4733.33	0.0205	0.12	16.94	60.06	55.46
4733.5	0.0217	0.15	17.86	63.55	58.74
4733.67	0.0232	0.17	16.86	64.59	59.71
4733.83	0.022	2.43	17.74	65.1	60.19
4734	0.0228	3.13	17.6	69.39	64.23
4734.17	0.0204	4.79	19.82	71.77	64.75
4734.33	0.0195	5.54	21.08	76.02	66.72
4734.5	0.019	10.63	18.09	78.75	54.37
4734.67	0.0184	12.51	18.27	82.82	52.83
4734.83	0.0206	12.23	18.3	87.97	58.74
4735	0.0214	12.39	17.43	89.45	59.73
4735.17	0.0238	13.2	15.84	94.23	62.08
4735.33	0.0268	11.77	15.01	95.62	67.68
4735.5	0.0257	13.13	13.72	96.21	64.23
4735.67	0.0239	11.48	12.16	95.56	68.49
4735.67	0.0239	11.48	12.16	95.56	68.49

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4735.83	0.0242	9.66	13.27	97.91	76.2
4736	0.0262	8.05	13.35	98.23	81.27
4736.17	0.0261	8.1	13.75	98.83	81.74
4736.33	0.0247	10.57	9.81	99.83	75.41
4736.5	0.0273	9.99	9.03	99.36	76.65
4736.67	0.0279	6.89	8.62	98.89	85.37
4736.83	0.0262	7.61	7.61	97.89	82.25
4737	0.0236	8.42	6.89	96.06	78.03
4737.17	0.0245	9.06	7.86	97.18	77.27
4737.33	0.0243	9.27	7.88	97.53	76.98
4737.5	0.0199	13.06	8.19	96	64.23
4737.67	0.0205	11.89	9.57	96.7	68.4
4737.83	0.0197	14.9	11.13	97.37	60.15
4738	0.0176	17.55	7.3	94.44	49.39
4738.17	0.0172	17.33	5.89	93.52	49.12
4738.33	0.0165	16.81	5.62	91.28	48.46
4738.5	0.0177	16.02	7.31	90.43	49.96
4738.67	0.0151	15.27	8.12	88.69	50.45
4738.83	0.0157	16.67	8.37	86.99	44.62
4739	0.0146	15	9.69	85.06	47.66
4739.17	0.015	12.87	10.05	82.5	51.43
4739.33	0.0158	13.21	6.58	80.49	48.43
4739.5	0.0141	12.02	6.88	76.41	47.92
4739.67	0.0154	8.92	8.53	76.08	56.77
4739.83	0.0151	8.27	7.1	72.32	54.98
4740	0.015	4.85	7.93	68.12	60.98
4740.17	0.016	1.11	14.18	68.15	63.06
4740.33	0.0166	0.18	14.86	68.3	63.2
4740.5	0.0171	0.22	15.14	69.76	64.57
4740.67	0.0146	0.17	15.54	69.5	64.33
4740.83	0.0145	1.13	15.18	69.13	63.98
4741	0.0147	0.15	15.17	69.52	64.35
4741.17	0.0197	0.1	14	70.77	65.52
4741.33	0.018	1.24	13.57	72.26	66.92
4741.5	0.0174	0.62	14.76	70.66	65.42
4741.67	0.017	2.9	15.53	71.12	65.85
4741.83	0.0187	2.18	17.51	71.18	65.91
4742	0.0177	1.79	18.42	69.99	64.79
4742.17	0.0158	4.79	17.18	70.57	63.56
4742.33	0.016	7	13.75	69.29	55.75
4742.5	0.0172	7.7	11.68	66.54	50.96
4742.67	0.0179	7.86	10.82	63.37	47.35
4742.83	0.0206	6.34	7.8	60.14	48.64
4743	0.0226	5.69	6.74	57.89	48.35
4743.17	0.0227	4.91	7.48	56.25	49.02
4743.33	0.0214	4.54	8.54	54.8	48.69
4743.5	0.0239	5.5	6.56	52.05	43.13
4743.67	0.0229	7.92	7.04	53.24	37.14
4743.83	0.0219	7.32	6.47	54.49	40.14

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4744	0.0198	7.99	6.04	54.52	38.18
4744.17	0.0216	9.15	5.37	56.53	36.75
4744.33	0.0248	5.36	8.28	56.18	47.64
4744.5	0.0246	3.42	8.72	56.17	51.8
4744.67	0.0222	4.44	9.47	57.86	52.02
4744.83	0.0187	6.28	10.36	59	47.68
4745	0.0175	9.59	12.74	60.56	39.43
4745.17	0.0173	9.48	15.39	62.8	41.99
4745.33	0.0172	10.23	16.14	63.57	40.51
4745.5	0.0168	11.78	12.74	64.24	36.58
4745.67	0.0149	10.12	14.57	65.12	42.38
4745.83	0.0173	6.6	15	64	51.69
4746	0.0185	5.47	14.09	65.21	56.24
4746.17	0.0191	5.48	12.12	65.04	56.04
4746.33	0.0156	5.61	13.42	66.92	57.52
4746.5	0.0137	8.42	10.67	70.25	52.49
4746.67	0.0169	10.2	9.01	73.63	50.57
4746.83	0.016	10.44	11.4	76.97	53.16
4747	0.0176	9.28	10.04	78.18	57.79
4747.17	0.02	6.67	8.96	79.42	66.76
4747.33	0.0184	6.42	5.91	78.86	66.93
4747.5	0.0177	5.19	5.3	77.41	69.16
4747.67	0.0174	4.98	6.08	76.1	68.48
4747.83	0.0159	5.46	5.57	75.52	66.48
4748	0.0149	5.63	5.72	74.67	65.14
4748.17	0.0164	6.02	6.22	71.91	61.25
4748.33	0.0162	5.57	6.25	70.69	61.36
4748.5	0.0182	4.06	7.08	67.87	62.8
4748.67	0.017	1.83	9.19	64	59.16
4748.83	0.0137	1.38	12.71	61.51	56.82
4749	0.0155	1.82	11.67	57.53	53.08
4749.17	0.0181	0.76	13.63	56.82	52.41
4749.33	0.0159	2.17	14.29	55.4	51.07
4749.5	0.0169	3	13.68	57.52	53.07
4749.67	0.0171	3.9	13.63	59.55	54.98
4749.83	0.0161	4.02	15.78	62.4	57.66
4750	0.0183	3.2	18.45	65.02	60.12
4750.17	0.0154	2.81	20.4	66.22	61.24
4750.33	0.015	2.01	21.23	68.17	63.08
4750.5	0.0152	0.19	22.35	69.12	63.97
4750.67	0.0166	0.53	19.14	70.27	65.05
4750.83	0.0179	3.95	15.88	71.44	66.15
4751	0.0183	3.42	15.08	71.88	66.57
4751.17	0.0174	2.13	15.33	72.61	67.25
4751.33	0.0171	3.04	12.64	71.18	65.91
4751.5	0.0169	1.89	11.97	71.54	66.25
4751.67	0.0172	1.69	11.93	69.82	64.63
4751.83	0.0159	1.81	13.63	68.65	63.54
4752	0.0128	1.37	14.76	67.18	62.15

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4752.17	0.0096	0.98	15.27	65.38	60.46
4752.33	0.012	2.01	13.38	66.39	61.41
4752.5	0.0111	2.87	12	66.01	61.05
4752.67	0.0126	5.61	10.22	66.54	57.13
4752.83	0.0126	6.64	11.32	67.05	54.6
4753	0.0146	3.8	11.88	68.22	63.13
4753.17	0.0143	3.47	11.17	67.8	62.73
4753.33	0.015	4.64	8.34	67.12	60.59
4753.5	0.015	3.9	9.47	68.23	63.13
4753.67	0.0141	6.51	11.44	67.04	54.96
4753.83	0.0159	6.17	11.16	65.24	54.19
4754	0.0188	3.69	10.73	64.03	59.19
4754.17	0.0244	2.47	8.38	62.34	57.6
4754.33	0.026	2.26	5.88	59.99	55.39
4754.5	0.0266	1.5	6.55	56.16	51.79
4754.67	0.0244	1.05	7.66	52.46	48.31
4754.83	0.0223	1.5	8.42	48.53	44.62
4755	0.0196	1.9	9.59	45.82	42.07
4755.17	0.0212	1.8	8.16	43.19	39.6
4755.33	0.0239	1.45	7.36	40.98	37.52
4755.5	0.0239	0.14	9.3	38.36	35.06
4755.67	0.0224	0.1	8.79	35.18	32.07
4755.83	0.0278	0.18	6.51	33.9	30.86
4756	0.0283	0.17	6.83	33.48	30.47
4756.17	0.0264	0.11	7.52	32.83	29.86
4756.33	0.0264	0.12	7.87	32.06	29.13
4756.5	0.0288	0.13	7.49	33.14	30.15
4756.67	0.0292	0.12	6.29	33.78	30.75
4756.83	0.0317	0.19	7.88	34.4	31.34
4757	0.0319	0.13	8.15	34.84	31.75
4757.17	0.0361	0.11	9.05	35.19	32.08
4757.33	0.0361	0.19	10.53	35.56	32.42
4757.5	0.0329	0.19	9.9	35.34	32.22
4757.67	0.0362	0.14	9.75	37.33	34.09
4757.83	0.0364	0.13	8.22	37.88	34.6
4758	0.0332	0.13	8.34	38.4	35.1
4758.17	0.0306	0.12	8.35	36.58	33.39
4758.33	0.0293	0.15	7.79	34.06	31.01
4758.5	0.0266	0.17	8.58	32.44	29.5
4758.67	0.0247	0.16	8.14	30.2	27.39
4758.83	0.0232	0.16	8.4	28.02	25.34
4759	0.021	0.15	5.67	26.04	23.48
4759.17	0.0202	0.16	2.83	23.18	20.79
4759.33	0.0165	0.19	0.78	21.05	18.79
4759.5	0.0149	0.17	1.82	17.97	15.89
4759.67	0.0183	0.1	1.3	16.19	14.22
4759.83	0.0156	0.14	0.12	12.07	10.34
4760	0.0151	0.15	0.2	10.71	9.07
4760.17	0.015	0.13	0.27	8.01	6.53

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4760.33	0.0144	0.19	0.4	7.1	5.55
4760.5	0.0152	0.1	0.19	7.35	5.91
4760.67	0.0148	0.11	0.1	6.63	5.05
4760.83	0.0161	0.12	0.19	5.97	4.25
4761	0.0156	0.1	0.18	6.55	5.16
4761.17	0.0185	1.35	0.14	25.28	22.77
4761.33	0.0227	0.19	0.18	24.61	22.13
4761.5	0.0222	0.18	0.1	23.37	20.97
4761.67	0.0207	0.18	0.11	21.98	19.66
4761.83	0.0213	0.14	0.15	21.46	19.18
4762	0.022	0.19	0.11	22.29	19.95
4762.17	0.0234	0.13	0.1	23.07	20.68
4762.33	0.027	0.13	0.15	23.93	21.49
4762.5	0.0285	0.17	0.16	24.36	21.9
4762.67	0.0317	0.11	0.16	24.59	22.12
4762.83	0.0319	0.13	0.16	22.9	20.53
4763	0.0313	0.11	0.19	21.98	19.66
4763.17	0.0302	0.12	0.19	21.5	19.21
4763.33	0.0315	0.2	0.13	20.75	18.51
4763.5	0.0302	0.16	0.13	20.04	17.84
4763.67	0.0299	0.18	0.1	19.03	16.89
4763.83	0.0326	0.11	0.1	18	15.92
4764	0.0326	0.11	1.25	17.25	15.22
4764.17	0.0317	0.18	0.28	15.54	13.61
4764.33	0.0307	0.17	0.19	13.27	11.47
4764.5	0.0315	0.12	0.13	11.51	9.82
4764.67	0.0314	0.18	0.15	10.52	8.84
4764.83	0.0298	0.19	0.18	7.9	6.13
4765	0.0303	0.12	0.19	7.22	5.26
4765.17	0.0316	0.19	0.18	5.78	4.27
4765.33	0.0285	0.11	0.2	5.24	3.92
4765.5	0.0266	0.1	0.13	5.43	3.49
4765.67	0.027	0.11	0.15	6.18	4.19
4765.83	0.0291	0.18	0.13	7.99	6.38
4766	0.027	0.16	0.3	10	8.4
4766.17	0.0294	0.1	0.15	11.88	10.14
4766.33	0.0299	0.19	0.14	12.85	10.93
4766.5	0.0293	0.2	0.2	13.31	11.51
4766.67	0.0289	0.2	0.14	13.96	12.12
4766.83	0.027	0.17	0.11	14.94	13.04
4767	0.0243	0.14	0.15	15	13.1
4767.17	0.0256	0.15	0.18	14.99	13.09
4767.33	0.0247	1.69	0.16	16.48	14.49
4767.5	0.0252	0.34	0.16	14.38	12.51
4767.67	0.0241	0.51	0.2	13.54	11.72
4767.67	0.0241	0.51	0.2	13.54	11.72
4767.83	0.024	0.11	0.2	12.33	10.42
4768	0.0213	0.13	0.12	11.88	10.08
4768.17	0.023	0.15	0.15	13.24	11.45

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4768.33	0.0174	0.53	0.16	12.31	10.58
4768.5	0.0173	0.52	0.13	11.7	9.99
4768.67	0.0177	0.13	0.23	12.02	10.19
4768.83	0.0152	0.15	0.53	13.18	11.21
4769	0.0177	0.1	0.13	10.94	9.29
4769.17	0.0199	0.11	1.38	11.38	9.7
4769.33	0.018	0.18	1.32	12.35	10.61
4769.5	0.0177	0.1	2.12	11.4	9.72
4769.67	0.0198	0.2	2.92	12.47	10.72
4769.83	0.0216	0.19	1.49	13.88	12.04
4770	0.0226	0.12	1.3	14.23	12.37
4770.17	0.0258	0.15	2.72	14.59	12.62
4770.33	0.0259	0.15	3.08	13.15	11.16
4770.5	0.0278	0.11	2.09	12.81	11.04
4770.67	0.0257	0.12	1.29	12.14	10.41
4770.83	0.0244	0.12	0.27	12.18	10.45
4771	0.0254	0.17	0.49	11.99	10.27
4771.17	0.0256	0.16	1.95	13.03	11.05
4771.33	0.0248	0.19	2.47	13.68	11.86
4771.5	0.0249	0.12	1.69	13.82	11.99
4771.67	0.025	0.13	0.11	13.95	11.98
4771.83	0.024	0.17	3.71	15.28	13.36
4772	0.0249	0.13	4.72	13.97	12.13
4772.17	0.0246	0.18	3.29	13.17	11.38
4772.33	0.0218	0.14	0.16	12.78	10.99
4772.5	0.0201	0.1	0.11	12.35	10.61
4772.67	0.0212	0.17	0.13	12.65	10.89
4772.83	0.0221	0.15	0.29	11.34	9.66
4773	0.0241	0.14	0.12	10.3	8.68
4773.17	0.0256	0.13	0.13	9.89	8.3
4773.33	0.0246	0.19	0.13	9.37	7.81
4773.5	0.0267	0.18	0.17	8.07	6.13
4773.67	0.0258	0.17	0.2	7.91	5.93
4773.83	0.0247	0.2	2.13	7.43	5.98
4774	0.0253	0.17	0.16	5.65	4.17
4774.17	0.0249	0.15	0.17	6.95	5.42
4774.33	0.0249	0.12	1.7	8.7	7.17
4774.5	0.0246	0.1	3.72	6.97	5.31
4774.67	0.0242	0.11	3.78	6.6	5.03
4774.83	0.0227	0.14	5.88	6.07	4.63
4775	0.0215	0.2	4.14	7.05	5.39
4775.17	0.0204	0.14	2.43	6.66	5.26
4775.33	0.019	0.12	2.27	5.05	3.75
4775.5	0.021	0.14	0.2	6.62	5.22
4775.67	0.0194	0.19	0.12	6.97	5.55
4775.83	0.0187	0.17	0.14	6.49	4.55
4776	0.0189	0.13	0.11	7.27	5.62
4776.17	0.0183	0.17	0.15	8.47	6.6
4776.33	0.018	0.15	0.17	8.18	6.53

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4776.5	0.0153	0.15	0.14	7.94	6.28
4776.67	0.0167	0.11	0.11	10.94	9.07
4776.83	0.0174	0.21	0.13	12.33	10.59
4777	0.0192	1.28	0.16	14.17	12.32
4777.17	0.0199	0.2	0.17	16.25	14.28
4777.33	0.0215	0.15	0.16	18.25	16.16
4777.5	0.0223	0.16	0.1	21.08	18.82
4777.67	0.0207	0.19	0.11	21.3	19.02
4777.83	0.0196	0.2	0.18	23.61	21.19
4778	0.0205	0.16	0.17	25.68	23.14
4778.17	0.0212	0.15	0.13	27.14	24.51
4778.33	0.0188	0.13	0.15	28.39	25.69
4778.5	0.0199	0.12	0.19	29.22	26.46
4778.67	0.0224	0.19	0.12	30.1	27.29
4778.83	0.0236	0.13	0.15	30.37	27.55
4779	0.0266	0.19	0.14	31.31	28.43
4779.17	0.0295	0.13	0.1	32.35	29.41
4779.33	0.032	0.1	0.13	35.18	32.07
4779.5	0.0312	0.14	0.32	38	34.72
4779.67	0.0319	0.19	1.31	40.25	36.84
4779.83	0.0323	0.2	1.62	42.78	39.21
4780	0.0313	0.2	4.76	43.59	39.97
4780.17	0.035	0.17	4.19	44.38	40.72
4780.33	0.0329	0.13	7.84	45.78	42.03
4780.5	0.0374	0.17	7.52	48.49	44.58
4780.67	0.0365	0.16	9.53	49.17	45.22
4780.83	0.0319	0.83	11.73	50.7	46.66
4781	0.0304	1	13.83	52.22	48.08
4781.17	0.0277	3.12	14.28	53.68	49.46
4781.33	0.0254	4.49	14.25	54.04	48.09
4781.5	0.0241	4.38	12.88	52.19	46.59
4781.67	0.0225	4.95	13.12	51.47	44.17
4781.83	0.0205	3.82	12.34	49.66	45.68
4782	0.0215	4.48	11.8	49.04	43.15
4782.17	0.0254	3.66	10.08	50.14	46.13
4782.33	0.0223	5.58	11.28	50.52	41.39
4782.5	0.0248	4.59	9.03	50.66	44.46
4782.67	0.0244	2.49	8.39	49.19	45.24
4782.83	0.0236	4.45	6.98	49.64	43.83
4783	0.0273	4.38	5.72	48.55	42.97
4783.17	0.0283	5.27	1.81	47.28	39.09
4783.33	0.0297	3.99	0.17	44.72	40.35
4783.5	0.0308	3.65	0.25	43.11	39.52
4783.67	0.0322	3.07	0.11	42.31	38.77
4783.83	0.0333	1.49	0.13	41.79	38.28
4784	0.0363	0.37	0.2	41.76	38.25
4784.17	0.0367	0.1	1.27	41.07	37.61
4784.33	0.0333	0.24	1.41	39.21	35.85
4784.5	0.0364	0.17	0.98	38.86	35.53

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4784.67	0.0361	0.16	0.6	39.64	36.26
4784.83	0.0351	0.6	1.5	39.13	35.78
4785	0.0345	0.19	2.4	40.06	36.66
4785.17	0.0371	0.1	1.94	41.21	37.74
4785.33	0.0366	0.11	4.66	42.87	39.29
4785.5	0.0347	0.14	4.93	44.31	40.66
4785.67	0.0322	0.14	4.19	45.61	41.88
4785.83	0.0333	0.54	3.63	47.17	43.34
4786	0.0353	2.01	3.66	47.12	43.29
4786.17	0.0333	3.66	3.96	47.53	43.68
4786.33	0.0324	4.47	2.2	47.25	41.41
4786.5	0.0368	3.19	0.14	48.6	44.68
4786.67	0.0343	3.3	2.3	48.45	44.54
4786.83	0.0352	1.2	2.56	47.44	43.6
4787	0.0374	1.89	1.16	48.64	44.73
4787.17	0.0364	4.68	1.58	47.12	40.67
4787.33	0.0329	5.38	2.13	47.72	39.2
4787.5	0.0302	5.67	2.54	44.52	35.16
4787.67	0.03	4.78	2.59	43.59	36.87
4787.83	0.0322	5.07	1.86	42.9	35.33
4788	0.0308	3.74	2.79	41	37.4
4788.17	0.0293	3.33	2.3	41.02	37.56
4788.33	0.0301	3.03	1.73	40.63	37.19
4788.5	0.0294	3.58	2.28	40.95	37.49
4788.67	0.0273	4.74	2.59	39.96	33.41
4788.83	0.0261	7.3	0.12	40.03	25.89
4789	0.0248	6.75	0.88	38.88	26.39
4789.17	0.0309	0.19	8.65	40.15	36.74
4789.33	0.03	0.14	8.14	40.95	37.49
4789.5	0.0282	0.13	6.14	39.72	36.34
4789.67	0.0294	0.14	5.13	41.49	38
4789.83	0.0317	0.16	4.57	42.11	38.58
4790	0.0315	0.19	5.63	42.04	38.51
4790.17	0.0313	0.1	5.75	42.83	39.26
4790.33	0.0293	0.13	7.57	41.71	38.21
4790.5	0.0295	0.15	4.02	40.84	37.39
4790.67	0.0283	0.11	2.32	40.7	37.26
4790.83	0.0256	0.12	3.54	37.84	34.57
4791	0.0232	0.18	5.81	37.34	34.1
4791.17	0.0246	0.17	1.47	36.81	33.6
4791.33	0.025	0.12	2.53	37.71	34.45
4791.5	0.0264	0.1	0.34	36.92	33.7
4791.67	0.0285	0.13	0.18	37.32	34.08
4791.83	0.0289	0.13	1.11	34.81	31.72
4792	0.0254	0.14	1.61	33.44	30.44
4792.17	0.0236	0.19	1.15	31.92	29
4792.33	0.0221	0.2	0.19	29.63	26.85
4792.5	0.0244	0.16	0.14	28.65	25.93
4792.67	0.0264	0.2	0.11	27.3	24.66

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4792.83	0.0254	0.14	0.9	26.38	23.8
4793	0.0264	0.18	0.33	28.25	25.55
4793.17	0.0278	0.14	0.11	28.76	26.03
4793.33	0.032	0.15	0.15	31.54	28.64
4793.5	0.033	0.18	0.76	31.96	29.04
4793.67	0.0332	0.16	1.88	32.35	29.41
4793.83	0.0314	0.16	0.62	30.78	27.94
4794	0.0282	0.11	1.09	30.86	28.01
4794.17	0.0281	0.19	0.1	29.87	27.08
4794.33	0.0283	0.55	0.19	28.43	25.72
4794.5	0.0282	0.19	2.21	27.5	24.85
4794.67	0.0254	0.34	3	26.47	23.88
4794.83	0.025	0.17	1.97	24.38	21.91
4795	0.0233	0.33	0.72	22.62	20.27
4795.17	0.0207	0.11	0.4	21.52	19.23
4795.33	0.0219	0.11	0.17	20.97	18.71
4795.5	0.0182	0.13	1.64	18.12	16.03
4795.67	0.0147	1.3	0.16	16.89	14.88
4795.67	0.0147	1.3	0.16	16.89	14.88
4795.83	0.0125	0.13	0.16	16.79	14.78
4796	0.0131	0.16	0.9	19.26	17.11
4796.17	0.0177	0.11	1.32	21.89	19.57
4796.33	0.0185	0.13	6.86	26.03	23.47
4796.5	0.0184	0.16	7.97	30.56	27.73
4796.67	0.0224	0.17	5.43	33.94	30.9
4796.83	0.022	0.19	6.59	38.05	34.77
4797	0.0208	0.37	7.88	41.61	38.11
4797.17	0.0235	1.69	6.3	43.18	39.59
4797.33	0.0263	3.45	4.71	44.72	41.04
4797.5	0.0236	4.49	7.07	45.09	39.22
4797.67	0.0253	3.58	7.86	46.54	42.75
4797.83	0.0289	0.17	9.23	46.03	42.27
4798	0.0296	1.48	11.34	45.3	41.58
4798.17	0.0281	2.51	11.55	45.14	41.43
4798.33	0.0233	5.01	8.16	43.22	35.82
4798.5	0.024	6.77	4.27	38.86	26.32
4798.67	0.026	6.48	0.97	36.01	24.34
4798.83	0.0208	6.77	1.03	31.87	19.37
4799	0.0234	5.93	0.12	29.89	19.9
4799.17	0.022	2.58	2.05	28.43	25.72
4799.33	0.0227	0.83	3.46	28.48	25.77
4799.5	0.0209	0.34	5.31	27.71	25.05
4799.67	0.0227	0.12	4.24	26.63	24.04
4799.83	0.0212	0.11	2.22	24.42	21.96
4800	0.0187	0.8	3.7	22.74	20.38
4800.17	0.0162	0.18	1.88	18.59	16.48
4800.33	0.0154	0.19	4.29	14.88	12.98
4800.5	0.0131	0.13	5.41	11.36	9.68
4800.67	0.0107	0.19	6.54	9.08	7.19

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4800.83	0.0086	0.14	7.63	6.47	5.06
4801	0.0063	0.15	11	6.93	5.52
4801.17	0.0066	0.14	7.98	5.43	4.03
4801.33	0.0086	0.14	3.92	4.3	2.3
4801.5	0.0092	0.13	4.21	4.56	2.99
4801.67	0.0107	0.18	3.89	6.92	5.51
4801.83	0.0098	0.15	2.87	7.67	6.02
4802	0.0122	0.12	2.51	8.85	7.32
4802.17	0.0151	0.14	0.19	11.77	10.07
4802.33	0.0191	0.14	0.14	16.04	14.08
4802.5	0.0223	0.14	0.16	18.08	16
4802.67	0.0271	0.17	0.13	20.78	18.54
4802.83	0.0285	0.16	0.13	23.1	20.72
4803	0.0312	0.11	0.19	25.08	22.57
4803.17	0.0349	0.13	0.13	27.14	24.51
4803.33	0.0334	0.2	0.11	28.84	26.11
4803.5	0.0328	0.12	0.1	29.54	26.77
4803.67	0.032	0.15	0.14	28.65	25.93
4803.83	0.0322	0.16	0.13	26.79	24.18
4804	0.0329	0.15	0.17	27.81	25.14
4804.17	0.0291	1.92	0.14	27.66	25
4804.33	0.0277	1.49	0.18	27.86	25.19
4804.5	0.0243	2.02	0.18	28.45	25.74
4804.67	0.0221	4.19	0.2	29.07	24.26
4804.83	0.0218	2.66	0.17	30.19	27.38
4805	0.0207	2.4	1.49	30.22	27.41
4805.17	0.0205	3.49	1.5	30.24	27.43
4805.33	0.0196	2.07	1.29	29.14	26.39
4805.5	0.019	2.34	0.25	28.54	25.83
4805.67	0.0171	2.87	0.16	29.31	26.55
4805.83	0.0152	4.31	0.15	29.82	24.62
4806	0.0169	4.01	0.11	29.37	25.08
4806.17	0.0149	1.64	0.2	28.03	25.35
4806.33	0.0159	1.19	0.19	27.79	25.12
4806.5	0.0176	0.5	0.15	26.32	23.74
4806.67	0.0186	0.17	2.27	24.89	22.4
4806.83	0.0208	0.17	2.67	24.73	22.24
4807	0.0201	0.17	1.27	24.75	22.27
4807.17	0.0235	0.18	0.19	25.97	23.41
4807.33	0.024	0.16	0.27	26.71	24.11
4807.5	0.0256	0.11	0.41	26.38	23.8
4807.67	0.028	0.17	1.18	27.04	24.42
4807.83	0.0296	0.16	0.57	26.08	23.52
4808	0.0309	0.18	0.15	24.75	22.27
4808.17	0.0293	0.13	0.22	24.77	22.29
4808.33	0.0308	0.16	1.92	24.86	22.37
4808.5	0.0311	0.16	1.09	24	21.56
4808.67	0.0268	0.12	0.25	22.68	20.32
4808.83	0.0286	0.2	0.15	23.73	21.31

Core Spectral Gamma

PETROLEUM SERVICES

Company: Pacific Gas & Electric
Well Name: Piacentine 2-27
Field: King Island Gas

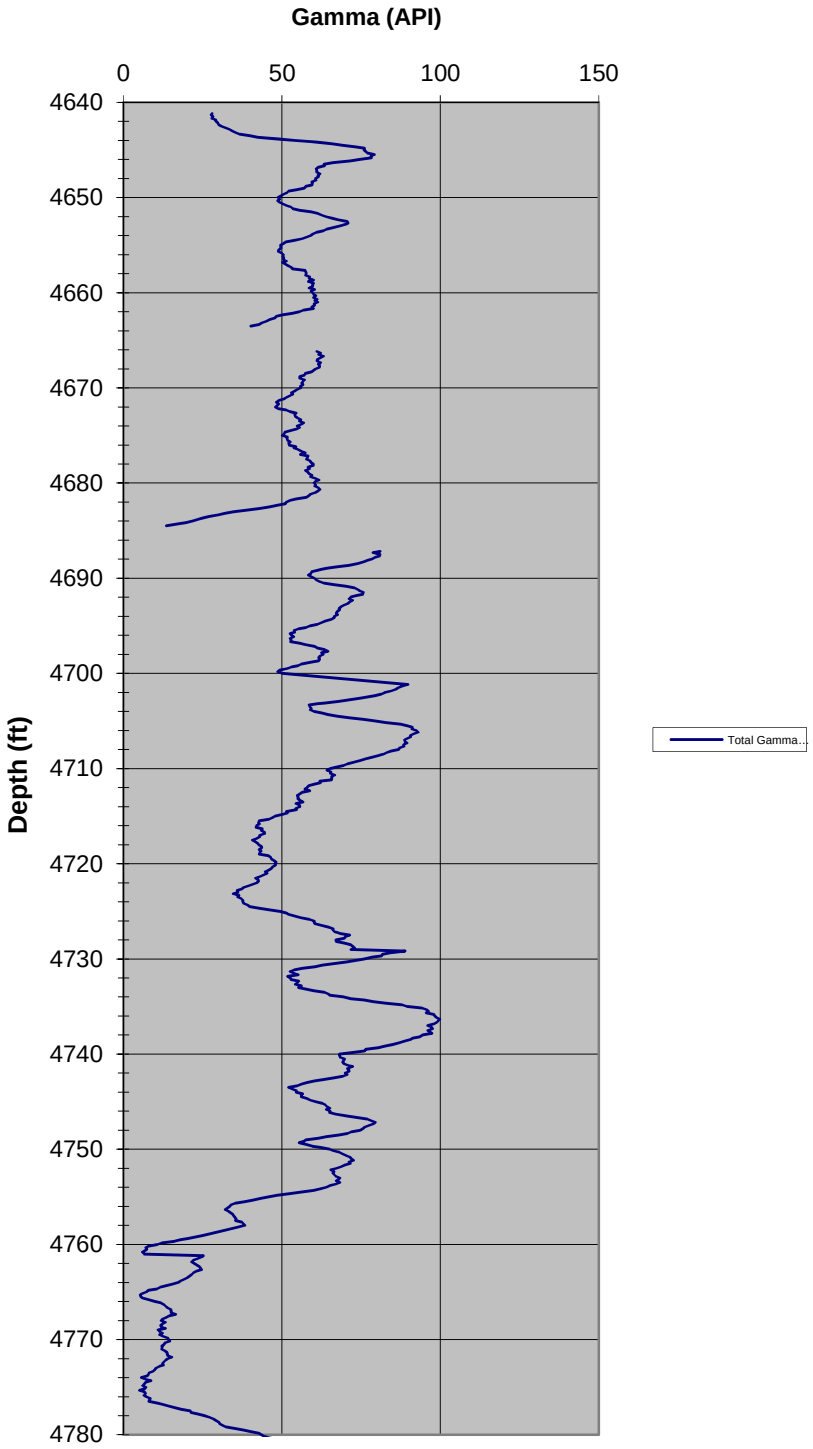
CL File No.: 57111-113011PG

Depth, ft	Potassium %	Uranium ppm	Thorium ppm	Total Gamma API	U-Free Gamma API
4809	0.0293	0.16	0.11	24.06	21.61
4809.17	0.031	0.18	0.14	23.71	21.29
4809.33	0.031	1.45	0.19	23.79	21.37
4809.5	0.032	0.84	0.17	23.71	21.29
4809.67	0.0328	0.18	0.11	23.84	21.41
4809.83	0.0309	2.03	0.16	23.89	21.46
4810	0.0324	0.11	3.45	24.17	21.72
4810.17	0.0329	0.15	4.6	25.22	22.71
4810.33	0.032	0.14	5.86	25.81	23.26
4810.5	0.0359	0.18	3.3	26.54	23.95
4810.67	0.0372	0.18	3.86	27.52	24.87
4810.83	0.0394	0.11	3.89	29.22	26.47
4811	0.0409	0.19	4.44	28.87	26.14
4811.17	0.0402	0.14	4.17	28.54	25.82
4811.33	0.038	0.17	6.81	26.89	24.28
4811.5	0.0349	0.18	5.02	26	23.44
4811.67	0.034	0.12	5.94	25.12	22.61
4811.83	0.0326	0.1	6.5	25.85	23.3
4812	0.0345	0.17	4.4	25.11	22.6
4812.17	0.0326	0.14	0.92	24.03	21.59
4812.33	0.0326	0.12	0.18	22.85	20.48
4812.5	0.0315	0.17	0.28	20.76	18.51
4812.67	0.0282	0.13	0.39	21.01	18.75
4812.83	0.0261	0.34	0.12	21.53	19.24
4813	0.0275	1.98	0.14	21.65	19.35
4813.17	0.0269	2.87	0.18	21.26	18.98
4813.33	0.0261	2.98	0.14	22.26	19.93
4813.5	0.0257	4.43	0.65	24.75	19.27
4813.67	0.0289	2.05	0.94	27.41	24.77
4813.83	0.0313	3.4	0.12	30.75	27.9
4814	0.0314	3.88	0.19	32.23	28.3
4814.17	0.0293	5.71	0.13	35.94	26.57
4814.33	0.0307	7.39	0.17	39.8	25.4
4814.5	0.0293	8.03	2.25	44.7	28.36
4814.67	0.0306	7.7	2.43	50.38	34.95
4814.83	0.0284	8.71	4.63	53.22	34.79
4815	0.0266	10.73	6.66	54.14	29.71
4815.17	0.0251	10.57	9.27	56.09	32.11
4815.33	0.0232	11.16	8.37	58.92	33.15
4815.5	0.0226	11.92	8.99	60.61	32.59
4815.67	0.0239	13.24	6.7	62.3	30.33
4815.83	0.0213	13.88	9.38	63.09	29.24
4816	0.0135	15.19	12.83	63.99	26.24

Pacific Gas & Electric
Well: Piacentine 2-27
Field: King Island Gas

Core Laboratories

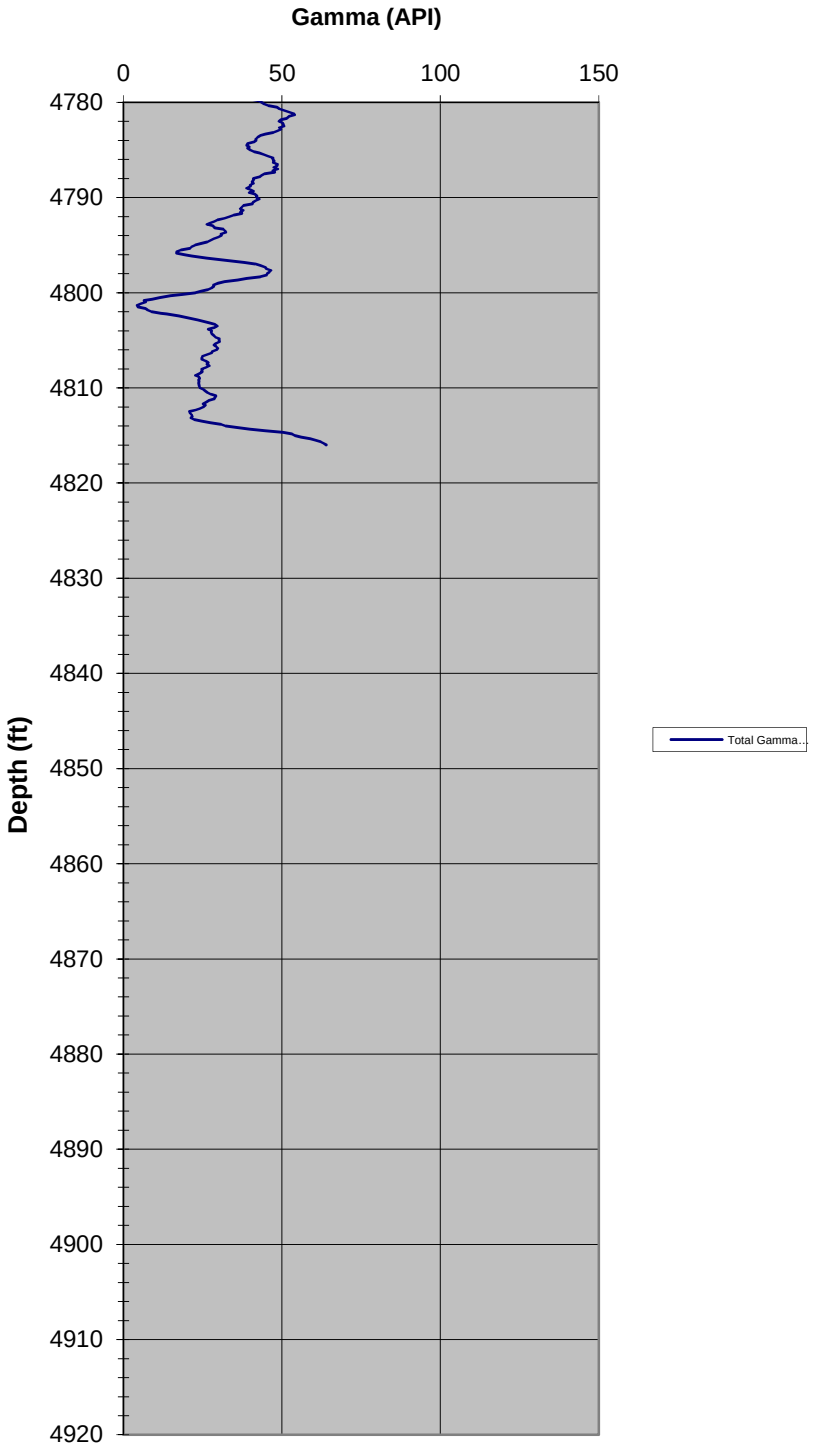
Total Gamma API



Pacific Gas & Electric
Well: Piacentine 2-27
Field: King Island Gas

Core Laboratories

Total Gamma API



Core Lab
RESERVOIR OPTIMIZATION

Petroleum Services

CMS Core Analysis

Pacific Gas and Electric Company

Piacentine 2-27 Well

King Island Field
San Joaquin County, California

FINAL REPORT

June 19, 2012

CL File: 57111-513116PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Petroleum Services Division
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Tel: 661-325-5657
Fax: 661-325-5808
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June 19, 2012

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm 2510C
San Ramon, CA 94583

Subject: CMS Core Analysis
File No.: 57111-513116PG

Dear Mr. Chan:

Enclosed are final data for 15 samples obtained from conventional core well Piacentine 2-27, King Island Field, San Joaquin County, CA.

Porosity and permeability data were determined at 250, 800, 2700 and 3100psi confining stress. Basic procedures used for this project are documented on the following pages for reference.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. Please do not hesitate to contact us at (661-325-5657) if you have any questions regarding these results or if we can be of any additional service.

Sincerely,
Core Laboratories LP

Larry Kunkel
Area Manager

Distribution: 1 original report, 1 CD copy: Addressee

Client: **Pacific Gas and Electric, Co.**
Well: Piacentine 2-27
Field: King Island Gas
Location: San Joaquin County, CA

CL File No: 513116PG
Date: 06.17.2013
Analyst(s): JK, NR

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Footnote
				Klinkenberg (md)	Kair (md)					
1	4723.60	250	35.1		2352				2.64	(6)
1	4723.60	800	34.3	1555	1598	0.35	2.66E+06	1.34E+01	2.64	
1	4723.60	2700	31.4	757	805	0.80	5.06E+06	1.24E+01	2.64	
1	4723.60	3100	31.0	678	724	0.85	5.62E+06	1.23E+01	2.64	
2	4725.60	250	32.2		275				2.65	(6)
2	4725.60	800	31.3	189	209	1.47	1.87E+07	1.14E+01	2.65	
2	4725.60	2700	28.6	121	133	1.34	4.17E+07	1.64E+01	2.65	
2	4725.60	3100	28.2	103	120	2.22	2.79E+07	9.30E+00	2.65	
3	4755.60	250	27.4		10.2				2.69	(6)
3	4755.60	800	26.3	4.23	5.85	6.66	1.97E+09	2.70E+01	2.69	
3	4755.60	2700	24.9	2.81	3.92	6.85	1.13E+10	1.03E+02	2.69	
3	4755.60	3100	24.7	2.64	3.74	7.23	7.29E+09	6.23E+01	2.69	
4	4757.10	250	36.9		6820				2.65	(6)
4	4757.10	800	35.8	3511	3779	0.94	6.83E+05	7.77E+00	2.65	
4	4757.10	2700	32.2	1707	1782	0.54	2.17E+06	1.20E+01	2.65	
4	4757.10	3100	31.8	1471	1552	0.68	2.25E+06	1.07E+01	2.65	
5	4757.70	250	36.2		5766				2.64	(6)
5	4757.70	800	34.8	3047	3169	0.49	1.19E+06	1.17E+01	2.64	
5	4757.70	2700	31.3	1389	1477	0.78	2.51E+06	1.13E+01	2.64	
5	4757.70	3100	30.9	1251	1327	0.75	2.90E+06	1.18E+01	2.64	

Client: **Pacific Gas and Electric, Co.**
Well: Piacentine 2-27
Field: King Island Gas
Location: San Joaquin County, CA

CL File No: 513116PG
Date: 06.17.2013
Analyst(s): JK, NR

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Footnote
				Klinkenberg (md)	Kair (md)					
6	4758.40	250	36.9		9998				2.66	(6)
6	4758.40	800	35.8	5233	5463	0.54	5.68E+05	9.62E+00	2.66	
6	4758.40	2700	32.8	2687	2847	0.72	1.07E+06	9.31E+00	2.66	
6	4758.40	3100	32.5	2467	2594	0.63	1.20E+06	9.59E+00	2.66	
7	4767.60	250	35.1		9680				2.63	(6)
7	4767.60	800	33.7	3474	4214	2.62	6.47E+05	7.28E+00	2.63	
7	4767.60	2700	30.1	1811	2018	1.40	2.12E+06	1.24E+01	2.63	
7	4767.60	3100	29.7	1539	1730	1.53	2.32E+06	1.16E+01	2.63	
8	4768.40	250	34.7		10373				2.63	(6)
8	4768.40	800	33.0	3528	3993	1.62	8.96E+05	1.02E+01	2.63	
8	4768.40	2700	29.7	1748	1875	0.90	2.51E+06	1.42E+01	2.63	
8	4768.40	3100	29.2	1440	1582	1.21	2.70E+06	1.26E+01	2.63	
9	4771.30	250	33.3		7050				2.65	(6)
9	4771.30	800	31.9	2325	2798	2.53	1.19E+06	8.96E+00	2.65	
9	4771.30	2700	28.5	1071	1213	1.65	3.55E+06	1.23E+01	2.65	
9	4771.30	3100	28.1	961	1077	1.51	4.22E+06	1.31E+01	2.65	
10	4773.40	250	36.7		19496				2.60	(6)
10	4773.40	800	34.5	4973	5594	1.52	6.31E+05	1.01E+01	2.60	
10	4773.40	2700	30.5	1935	2167	1.46	1.72E+06	1.08E+01	2.60	
10	4773.40	3100	30.0	1722	1885	1.16	2.17E+06	1.21E+01	2.60	

Client: **Pacific Gas and Electric, Co.**
Well: Piacentine 2-27
Field: King Island Gas
Location: San Joaquin County, CA

CL File No: 513116PG
Date: 06.17.2013
Analyst(s): JK, NR

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Footnote
				Klinkenberg (md)	Kair (md)					
11	4777.40	250	34.2		17819				2.69	(6)
11	4777.40	800	32.3	5183	5411	0.53	6.50E+05	1.09E+01	2.69	
11	4777.40	2700	28.8	2036	2248	1.27	1.35E+06	8.93E+00	2.69	
11	4777.40	3100	28.3	1842	2010	1.11	1.66E+06	9.88E+00	2.69	
12	4778.40	250	29.9		788				2.88	(6)
12	4778.40	800	28.5	369	420	1.84	1.77E+07	2.11E+01	2.88	
12	4778.40	2700	25.9	153	187	2.96	3.46E+07	1.72E+01	2.88	
12	4778.40	3100	25.4	137	161	2.33	5.18E+07	2.30E+01	2.88	
13	4781.70	250	34.0		3618				2.64	(6)
13	4781.70	800	33.1	2190	2325	0.77	1.41E+06	9.95E+00	2.64	
13	4781.70	2700	30.7	1321	1409	0.83	2.48E+06	1.06E+01	2.64	
13	4781.70	3100	30.2	1205	1275	0.73	3.01E+06	1.17E+01	2.64	
14	4782.70	250	33.1		3347				2.63	(6)
14	4782.70	800	32.1	1853	1958	0.71	1.92E+06	1.15E+01	2.63	
14	4782.70	2700	29.4	1033	1102	0.83	3.71E+06	1.24E+01	2.63	
14	4782.70	3100	29.1	959	1017	0.76	4.23E+06	1.31E+01	2.63	

Client: **Pacific Gas and Electric, Co.**
Well: Piacentine 2-27
Field: King Island Gas
Location: San Joaquin County, CA

CL File No: 513116PG
Date: 06.17.2013
Analyst(s): JK, NR

CMS-300 CONVENTIONAL PLUG ANALYSIS

Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Grain Density (g/cm3)	Footnote
				Klinkenberg (md)	Kair (md)					
15	4784.70	250	36.7		1831				2.64	(6)
15	4784.70	800	31.1	1229	1303	0.77	3.09E+06	1.23E+01	2.64	
15	4784.70	2700	28.9	792	846	0.86	5.14E+06	1.32E+01	2.64	
15	4784.70	3100	28.6	746	787	0.70	6.10E+06	1.47E+01	2.64	

Footnotes :

(1) : Denotes fractured or chipped sample. Permeability and/or porosity may be optimistic.

(2) : Sample permeability below the measurement range of CMS-300 equipment at indicated net confining stress (NCS). Data unavailable.

(3) : Denotes very short sample, porosity may be optimistic due to lack of conformation of boot material to plug surface.

(4) : Sample contains bitumen or other solid hydrocarbon residue.

(5) : Denotes sample unsuitable for measurement at stress. Porosity determined using Archimedes bulk volume at ambient conditions.

(6): Klinkenberg permeability not measured at 250psi net confining stress due to 800psi minimum requirement for measurement.

Permeability greater than 0.1 mD measured using helium gas. Permeability less than 0.1 mD measured using nitrogen gas. All b values converted to b (air)

Client: **Pacific Gas and Electric, Co.**
Well: Piacentine 2-27
Field: King Island Gas
Location: San Joaquin County, CA

CL File No: 513116PG
Date: 06.17.2013
Analyst(s): JK, NR

APPENDIX A: EXPLANATION OF CMS-300 TERMS "b", "Beta, and "Alpha"

K_∞	=	Equivalent non-reactive liquid permeability, corrected for gas slippage, mD
K_{air}	=	Permeability to Air, calculated using K_∞ and b, mD
b	=	Klinkenberg slip factor, psi
β (Beta)	=	Forcheimer inertial resistance factor, ft^{-1}
α (Alpha)	=	A factor equal to the product of Beta and K_∞. This factor is employed in determining the pore level heterogeneity index, H_i.
H_i	=	$\log_{10}(\alpha\phi/RQI)$ α, microns = $3.238E^{-9}\ \beta K_\infty$
Ø	=	Porosity, fraction
RQI	=	Reservoir Quality Index, microns
RQI	=	$0.0314(K/\phi)^{0.5}$

For further information please refer to:

Jones, S.C.: "Two-Point Determination of Permeability and PV vs. Net Confining Stress" SPE Formation Evaluation (March 1988) 235-241.

Jones S.C.: "A Rapid Accurate Unsteady-State Klinkenberg Permeameter," Soc. Pet. Eng. J. (Oct. 1972) 383-397.

Jones, S.C.: "Using the Inertial Coefficient, β, To Characterize Heterogeneity in Reservoir Rock: SPE 16949 (September 1987).

Amaefule, J.O.; Kersey, D.G.; Marschall, D.M.; Powell, J.D.; Valencia, L.E.; Keelan, D.K.: "Reservoir Description: A Practical Synergistic Engineering and Geological Approach Based on Analysis of Core Data,: SPE Technical Conference (Oct. 1988) SPE 18167.

Client: **Pacific Gas and Electric, Co.**
Well: Piacentine 2-27
Field: King Island Gas
Location: San Joaquin County, CA

CL File No: 513116PG
Date: 06.17.2013
Analyst(s): JK, NR

CMS-300 CONVENTIONAL PLUG ANALYSIS PROTOCOL

Sample Preparation

The samples were encapsulated in Teflon tape, nickel foil, and stainless steel screens. All sample trims were archived.

Sample Drying

Samples were oven dried at 240° F to weight equilibrium (+/- 0.001 g).

Porosity

Porosity was determined using Boyle's Law technique by measuring grain volume at ambient conditions & pore volume at indicated net confining stresses (NCS)

Grain Density

Grain density values were calculated by direct measurement of grain volume and weight on dried plug samples.
Grain volume was measured by Boyle's Law technique.

Permeability

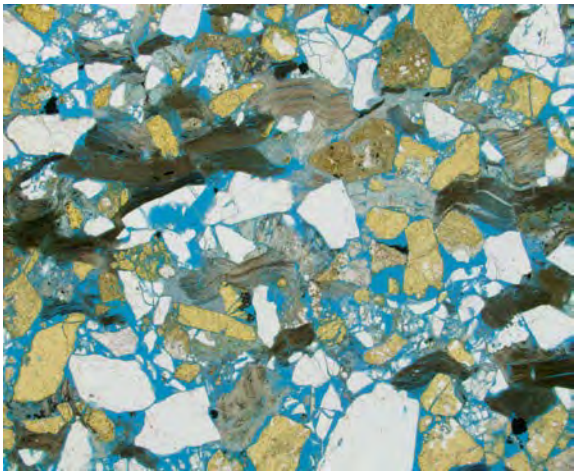
Permeability to air was measured on each sample using steady-state method at indicated NCS.

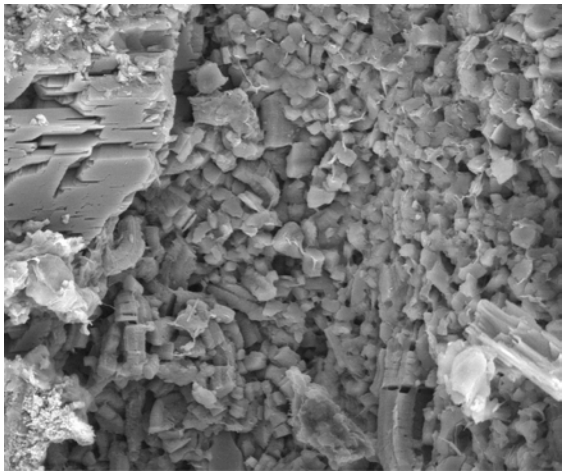
Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Petrologic Analysis of Conventional Core Samples

Pacific Gas & Electric Co.
Piacentine 2-27 Well
King Island Field
San Joaquin County, CA





Houston ATC Job File No.: 130585G

June 2013

Core Laboratories, Inc.
Houston Advanced Technology Center
6316 Windfern Road
Houston, Texas 77040

Core Laboratories
6316 Windfern Road
Houston, Texas 77040 USA
Tel: 713-460-9600
Fax: 713-460-4389

June 21, 2013

Joe Chan, P.E.
Principal Reservoir Engineer
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm 2510C
San Ramon, CA 94583

Dear Mr. Chan,

This report presents the results of Thin Section Petrography, Scanning Electron microscopy (SEM), and X-ray Diffraction analysis (XRD) performed on fifteen samples (15) from the **Piacentine 2-27 Well, King Island Field, San Joaquin County, California**. Samples range in depth from 4721.5 feet to 4785.5 feet. Samples are conventional core material. The analytical program and a summary of sample lithologies are presented in Table 1. XRD data are presented in Table 2. Thin section photomicrographs, scanning electron micrographs, and sample descriptions are provided in Plates 1 - 15.

The purpose of this study is to document each samples mineralogy, fabric and texture, authigenic constituents, and pore types. Some specific questions that are answered by this study include:

- The black material that comprises laminae in some samples is mostly biotite (Plate 11C), or in some cases, plant fragments (Plate 4) and heavy minerals (Plate 14A) such as amphibole.
- Pyrite occurs as scattered framboids in most samples, as larger patches in sample 4725.5 feet (Plate 2A), and replacing the plant fragment that makes up sample 4796.2 feet (Plate 15B). Patches of pyrite range up to cm-sized and framboids range in the tens of microns.
- Siderite occurs in minor amounts within flakes of biotite (Plate 3B) in several samples, and is common as both reworked granules and authigenic crystals in sample 4778.5 feet. The crystals range up to 80 microns in size.
- Oxidation rinds are not observed on the pyrite or siderite.

Fourteen of the samples are porous, loosely consolidated, micaceous sandstone, or sandstone. Grain size ranges from upper fine sand to very coarse sand. Samples show a range from poor to well sorted fabrics. Grains are typically subangular. Massive fabric, laminated fabric, and one disrupted argillaceous sample is observed (Plate 6). The presence of loosely-attached kaolinite cement that is susceptible to “wash-out” during thin section preparation, the partly dissolved plagioclase feldspar grains, and lack of carbonate or silicic cement has produced sample dilation that makes estimation of primary pores difficult.

TABLE 1

Pacific Gas & Electric Co., Piacentine 2-27 Well

ANALYTICAL PROGRAM AND SAMPLE SUMMARY

Sample ID	Depth (ft):	TS	SEM	XRD	Porosity (%)	Permeability (md)	Grain Density (g/cc)	Lithology:
75	**4721.50**	**X**	**X**	**X**	33.60	169.8	2.64	micaceous sandstone
79	**4725.50**	**X**	**X**	**X**	32.00	465.1	2.71	micaceous sandstone
87	**4733.50**	**X**	**X**	**X**	31.90	23.0	2.67	micaceous sandstone
109	**4755.50**	**X**	**X**	**X**	32.70	1475.7	2.66	micaceous sandstone
111	**4757.50**	**X**	**X**	**X**	34.90	3709.7	2.65	micaceous sandstone
117	**4763.50**	**X**	**X**	**X**	33.90	4345.4	2.63	sandstone
119	**4765.50**	**X**	**X**	**X**	35.40	4760.9	2.62	micaceous sandstone
124	**4770.50**	**X**	**X**	**X**	36.30	13197.8	2.63	sandstone
129	**4775.50**	**X**	**X**	**X**	35.60	19087.1	2.62	sandstone
132	**4778.50**	**X**	**X**	**X**	33.60	5514.1	2.74	sandstone
136	**4782.50**	**X**	**X**	**X**	32.00	1074.8	2.64	micaceous sandstone
139	**4785.50**	**X**	**X**	**X**	31.50	863.6	2.62	micaceous sandstone
142	**4788.50**	**X**	**X**	**X**	35.70	1133.6	2.65	micaceous sandstone
145	**4792.20**	**X**	**X**	**X**	44.10	14376.7	2.38	sandstone
149	**4796.20**	**X**	**X**	**X**	55.30	12667.0	2.04	coal/organic material

Framework grains are predominantly quartz (33.8-77.4 % by XRD). K-feldspar is typically the second most abundant grain type (8.7-14.3% by XRD), and plagioclase feldspar (3.8%-14.3% by XRD) is the third most abundant. Quartz grains are mostly monocrystalline (Plate 1B). Plagioclase includes polysynthetically twinned grains (Plate 5B) and clear grains. Quartz, K-feldspar, and plagioclase minerals make up the plutonic lithic fragments (Plate 6B) that occur in minor to moderate amounts. Minor amounts of volcanic (Plate 7B), metamorphic, and sedimentary (Plate 8B) fragments, plus rare chert (Plate 14B) are also present. Metamorphic rock fragments are typically micaceous. Biotite occurs as sand-sized grains and forms distinctive laminae in several samples (Plate 5A). Accessory grains include amphibole (Plate 8B), plant fragments (Plate 4C), opaque minerals, sphene, epidote, and zircon. Based on framework grain composition, the samples are mostly arkoses.

Clay mineralogy as determined by XRD (Table 2) requires explanation that integrates the thin section observations. Kaolinite is the most abundant clay as determined by XRD in all fourteen sandstone samples (up to 27.3 %). Kaolinite is authigenic in these samples: pore-filling (Plate 11B) and grain-replacing. Kaolinite replaces both biotite flakes (Plate 11B) and lithic fragments (Plate 9B). The Illite & Mica category includes detrital matrix and the biotite and muscovite flakes (0.0-6.6% by XRD). Detrital matrix is observed in several samples (Plate 6), and appears altered to kaolinite in some samples (Plate 3). The thin sections reveal significant amounts of detrital biotite in laminae, with some muscovite and chlorite. The thin sections may have been selectively sampled to show dark micaceous laminae, thereby giving a higher visual estimate of mica content than is listed in the Clay Mineralogy analysis. The thin sections also reveal that much of the biotite is altered to kaolinite (Plate 12B), is "bleached" (Plate 1B), or has altered to chlorite. The trace to minor amounts of mixed-layer illite/smectite detected in XRD (50-60% smectite layers) are either detrital, or occur as pore-bridging stringers within micas (Plate 13D) and authigenic kaolinite (Plate 3D). Chlorite detected in XRD is only observed within plutonic or metamorphic fragments, in chlorite-replaced biotite, and as rare detrital flakes.

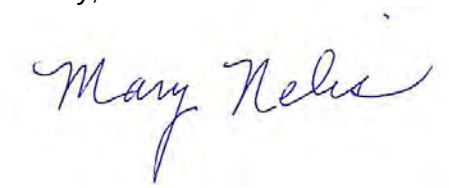
Siderite occurs as lozenge-shaped crystals within the sheets of biotite flakes in many samples (Plate 3B), and as composite granule-sized grains and prismatic cement (Plate 10B) in sample 4778.5 feet. K-feldspar overgrowths are the only other binding cement observed in the sandstone samples. The overgrowths are so small and discontinuous they are best observed in SEM (Plate 12D). K-feldspar overgrowths are rarely, barely visible in thin section.

Pore types in the sandstone samples include primary intergranular pores (Plate 4B), intragranular pores within plagioclase, K-feldspar, and lithic fragments, and abundant intercrystal micropores within authigenic kaolinite (Plate 10D). The intragranular pores are indicated in thin section by the grain-sized areas of plagioclase fragments (Plate 5B), as well as the direct observation of the pores in SEM and thin section (Plates 2D and 11D). Intercrystal micropores are indicated in thin section by the "blue haze" coloration of the kaolinite areas, and are directly visible in SEM.

Sample 4785.5 is a plant fragment that is partially replaced by authigenic pyrite (Plate 15).

Thank you for the opportunity to work on these samples. Please contact me at if you have any questions about this report.

Cordially,



Mary Nelis
Senior Geologist
Core Laboratories - Houston ATC
713-328-2561 mary.nelis@corelab.com

RESOURCES

Folk, R. L., 1980, Petrology of Sedimentary Rocks: Hemphill Publishing, Austin, Texas, 184p. http://www.lib.utexas.edu/geo/folkready/folkprefrev.html

ANALYTICAL PROCEDURES

Thin Sections:

Thin sections were prepared by first impregnating the samples with blue-stained epoxy to augment cohesion and to prevent loss of material during grinding. Each thinly sliced sample was mounted on a frosted glass slide and then cut and ground in water or oil to a thickness of 30 microns. The thin sections were stained with Alizarin Red-S to differentiate calcite (stains red) from dolomite and potassium ferricyanide (stains blue or purple) to distinguish ferroan carbonate varieties. The thin sections were analyzed using standard petrographic techniques in plane-polarized and cross polarized light. The thin sections were analyzed using standard petrographic techniques. Sandstone terminologies used in this report are those of Folk (1980). Photomicrograph images are calibrated for on-screen viewing.

X-ray Diffraction:

The sample selected for X-ray diffraction analysis was dried and flushed with methanol to remove any halides. The sample was crushed in a ceramic mortar to pass a 60-mesh sieve and weighed. The sample was then agitated in distilled water with a sonic probe for 5 minutes. The suspended <20 micron fraction was decanted, and the >20 micron fraction was washed to remove any remaining clays. The >20 fraction was dried and weighed to determine the percent of clay-sized material. This weight was used to determine the net-clay content of the sample. The suspended <20 micron fraction was suctioned onto a pure silver substrate. The resulting sample aggregate and substrate was dried and mounted on a glass slide. The >20 micron fraction was powdered in a McCrone micronizing mill with isopropanol and then packed into sample holders. The >20 micron fraction was scanned from 2 to 60 degrees two-theta at 1 degree per minute. The clay sample was run first in the natural (air-dried) state and then treated with ethylene glycol vapor for 24 hours and run again. Both clay runs were from 2 to 40 degrees at 1 degree per minute.

The XRD samples were analyzed with a Philips APD3600 X-ray diffractometer at a slow rate (1o/minute) using a copper tube (wavelength CuK alpha1 = 1.54051 angstroms) with 35 kilovolt potential and 35 milliamp current. Scintillator voltage was 800 volts and time constant was 1. A Data General Nova 4X was used to the collect and store data, whereas a Data General Eclipse S/140 was used for data reduction.

Compositions and species of the clay minerals were determined according to procedures outlined by Reynolds (1980, 1985), Srodon (1980, 1984), and Carroll (1970). Both whole rock and clay patterns were examined for mineral content, and integrated areas for the peaks were obtained using a multiple Lorentzian profile-fitting algorithm (Schreiner and Jenkins, 1983). The integrated areas were corrected for various absorption and orientation phenomena, with structure factors obtained from previous calibrations of each phase using a modified Chung method (1974a, b, and c). The corrected integrated areas were normalized to 100 percent. Any clay minerals trapped in the sand/silt fraction were mathematically removed and added to the

clay category. Any rock-forming minerals trapped in the clay fraction were also mathematically removed and added to the rock-forming mineral category. Using these methods, the accuracy of mineral weight percents is $\pm$2 percent of the fraction analyzed.

Scanning Electron Microscopy (SEM):

For the SEM/EDS Study, the samples were broken to form fresh surfaces. Shallower samples were then mounted on an aluminum stub and coated with a thin film of gold-palladium using a Technics "Hummer Jr." coating unit. The SEM photomicrographs are secondary electron images taken with a digital imaging system attached to a Scanning Electron Microscope operating at 10-20kV. Qualitative elemental data of selected phases observed during the SEM study were obtained through the use of an interfaced Kevex SIGMA energy dispersive spectroscopy (elemental X-ray) unit equipped with a Si (Li) detector. Recognition of authigenic clays was based on the criteria proposed by Wilson and Pittman (1977).

TABLE 1

Pacific Gas & Electric Co., Piacentine 2-27 Well

ANALYTICAL PROGRAM AND SAMPLE SUMMARY

Sample ID	Depth (ft):	TS	SEM	XRD	Porosity (%)	Permeability (md)	Grain Density (g/cc)	Lithology:
75	**4721.50**	**X**	**X**	**X**	33.60	169.8	2.64	micaceous sandstone
79	**4725.50**	**X**	**X**	**X**	32.00	465.1	2.71	micaceous sandstone
87	**4733.50**	**X**	**X**	**X**	31.90	23.0	2.67	micaceous sandstone
109	**4755.50**	**X**	**X**	**X**	32.70	1475.7	2.66	micaceous sandstone
111	**4757.50**	**X**	**X**	**X**	34.90	3709.7	2.65	micaceous sandstone
117	**4763.50**	**X**	**X**	**X**	33.90	4345.4	2.63	sandstone
119	**4765.50**	**X**	**X**	**X**	35.40	4760.9	2.62	micaceous sandstone
124	**4770.50**	**X**	**X**	**X**	36.30	13197.8	2.63	sandstone
129	**4775.50**	**X**	**X**	**X**	35.60	19087.1	2.62	sandstone
132	**4778.50**	**X**	**X**	**X**	33.60	5514.1	2.74	sandstone
136	**4782.50**	**X**	**X**	**X**	32.00	1074.8	2.64	micaceous sandstone
139	**4785.50**	**X**	**X**	**X**	31.50	863.6	2.62	micaceous sandstone
142	**4788.50**	**X**	**X**	**X**	35.70	1133.6	2.65	micaceous sandstone
145	**4792.20**	**X**	**X**	**X**	44.10	14376.7	2.38	sandstone
149	**4796.20**	**X**	**X**	**X**	55.30	12667.0	2.04	coal/organic material

Company: Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island

CL Bakersfield: 513095PG
CL Houston: 130585G
Date: 5/21/2013

Table 2

Conventional Core X-Ray Diffraction Data

			Bulk Mineralogy (Weight %)														Clay Mineralogy (Weight %)					
Depth (ft)	QCI[1]	d-space - Opal CT[2]	Quartz	Opal A	Opal CT	Plagioclase	K-Feldspar	Calcite	Fe/Mg-Dolomite	Siderite	Amphibole	Apatite	Gypsum	Anhydrite	Halite	Pyrite	Total Clay	Kaolinite	Chlorite	Illite & Mica	MXL I/S[3]	% Smectite in MXL I/S[3]	% Barite Removed[4]
4721.5	8.0	-	49.5	0.0	0.0	13.5	9.9	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	25.5	15.1	3.7	2.3	4.4	50-60	0.0
4725.5	8.0	-	44.5	0.0	0.0	8.3	13.8	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.5	31.1	22.3	4.2	2.4	2.2	50-60	0.0
4733.5	9.1	-	38.8	0.0	0.0	6.9	9.9	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	41.9	27.3	3.7	2.6	8.3	50-60	0.0
4755.5	7.6	-	43.9	0.0	0.0	11.2	13.6	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	1.0	28.1	17.7	3.0	4.2	3.2	50-60	0.0
4757.5	7.2	-	52.3	0.0	0.0	11.1	12.2	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.7	22.3	14.3	2.1	3.7	2.2	50-60	0.0
4763.5	8.2	-	64.5	0.0	0.0	4.9	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2	9.6	1.9	2.1	2.6	50-60	1.8
4765.5	5.8	-	56.3	0.0	0.0	4.2	9.3	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	29.2	16.3	4.6	6.6	1.7	50-60	0.0
4770.5	7.8	-	77.4	0.0	0.0	4.4	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	5.8	1.2	1.6	0.9	50-60	0.0
4775.5	7.3	-	74.7	0.0	0.0	6.5	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	3.6	1.2	2.2	1.0	50-60	0.0
4778.5	8.4	-	54.2	0.0	0.0	3.8	10.5	0.0	0.0	13.9	0.0	0.0	0.0	0.0	0.0	0.8	16.7	8.7	1.7	1.7	4.6	50-60	0.0
4782.5	6.7	-	52.9	0.0	0.0	6.5	11.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	18.0	1.4	5.3	3.9	50-60	0.0
4785.5	7.8	-	53.4	0.0	0.0	7.5	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.1	16.7	1.5	4.9	2.0	50-60	0.0
4788.5	7.4	-	48.7	0.0	0.0	14.0	12.3	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	22.9	14.7	1.7	3.0	3.5	50-60	0.0
4792.2	7.2	-	66.1	0.0	0.0	9.1	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	13.8	7.8	1.5	2.4	2.1	50-60	0.0
4796.2*	IQ	-	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.2	0.0	0.0	0.0	0.0	0.0	50-60	0.0

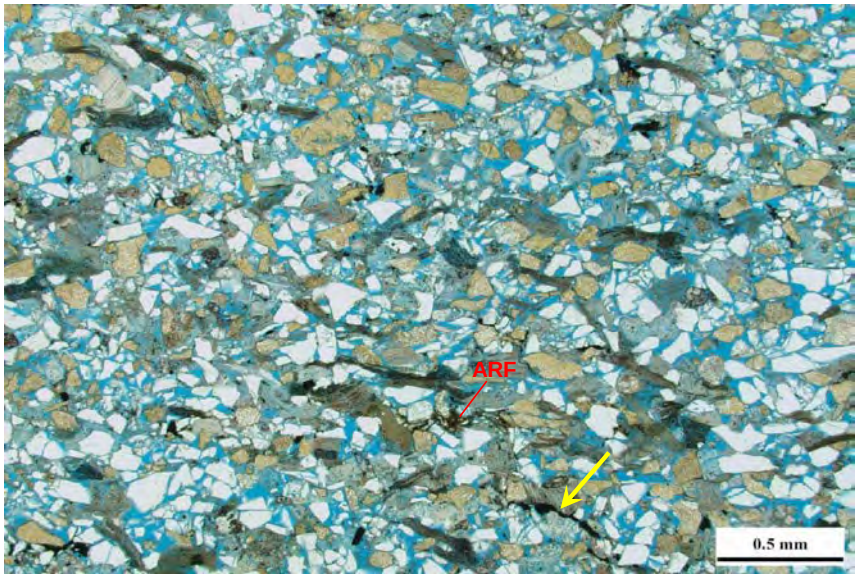
1 - Quartz crystallinity index
IQ - Insufficient quartz
2 -"d" {101} spacing - Stacking disorder in opal-CT causes shifts in the "d" {101} cristobalite peak. In general, with increasing diagenesis, as the opal-CT to quartz transformation progresses, the peak sharpens and the "d" {101} spacing decreases.
3 - MXL I/S = Mixed-layer illite-smectite
4 - Common Drilling Mud Contaminant
*Note - depth 4796.2' contains a significant amount of amorphous material, possibly organic.

PLATE 1

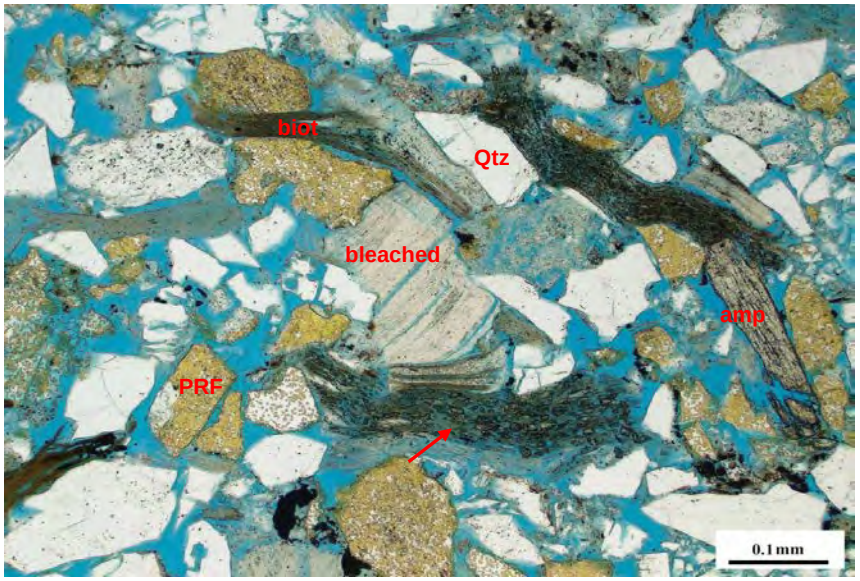
Thin Section & Epifluorescence Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4721.50
Sample ID: 75

A PL



B UV



Sample Description

Lithology: **micaceous sandstone**

Classif. (Folk, 1980): arkose
Grain Size (range): upper very fine sand
Sorting: moderate

Structures:
homogeneous with faint lamination defined by aligned micas

Framework Grains:
abundant quartz, common plagioclase, moderate K-feldspar, minor plutonic and metamorphic lithic fragments, rare chert

Other Grains:
common biotite and other mica flakes, moderate plant fragments, minor amphibole, minor kaolinite-replaced grains, trace garnet, phosphatic material, sphene

Matrix:
none observed

Authigenic minerals:
trace siderite within biotite flakes, moderate kaolinite replacing grains and mica flakes, minor framboidal pyrite

Pore Types:
abundant intergranular pores, minor secondary pores in feldspars and amphiboles, rare moldic pores, common intercrystal micropores in kaolinitic areas

XRD-Whole Rock Mineralogy (Weight %)

Quartz	49.5	Siderite	0.0
K-Feldspar	9.9	Amphibole	1.8
Plagioclase	13.5	Pyrite	0.0
		Total Clay	25.5

Clay Abundance (Weight %)

Illite / Smectite	4.4	Kaolinite	15.1
Illite & Mica	2.3	Chlorite	3.7

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows that this sandstone has a homogeneous fabric across the thin section, with faint alignment of biotite and other mica flakes. A rare squashed argillaceous grain (ARF) and a plant fragment (yellow arrow) are noted. Using higher magnification, some biotite flakes (biot) appear unaltered, some are bleached, and some exhibit minute siderite crystals between mica sheets (red arrow). Quartz (Qtz) is the most abundant framework grain type, with K-feldspars stained yellow, and some heavy minerals such as amphibole also present (amp). Plutonic lithic fragments (PRF) are typically composed of quartz, plagioclase and K-feldspar.

Core Lab
RESERVOIR OPTIMIZATION

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	33.6
Permeability (md)*:	169.8
Grain Density (g/cc):	2.64

PLATE 1 (cont'd)

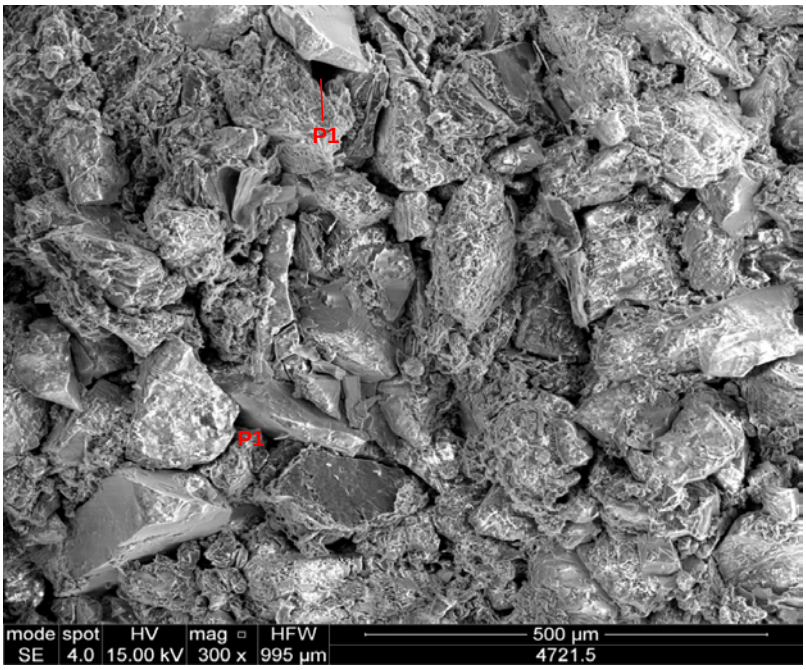
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4721.5
Sample ID: 75

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): upper very fine sand
Sorting: moderate

C



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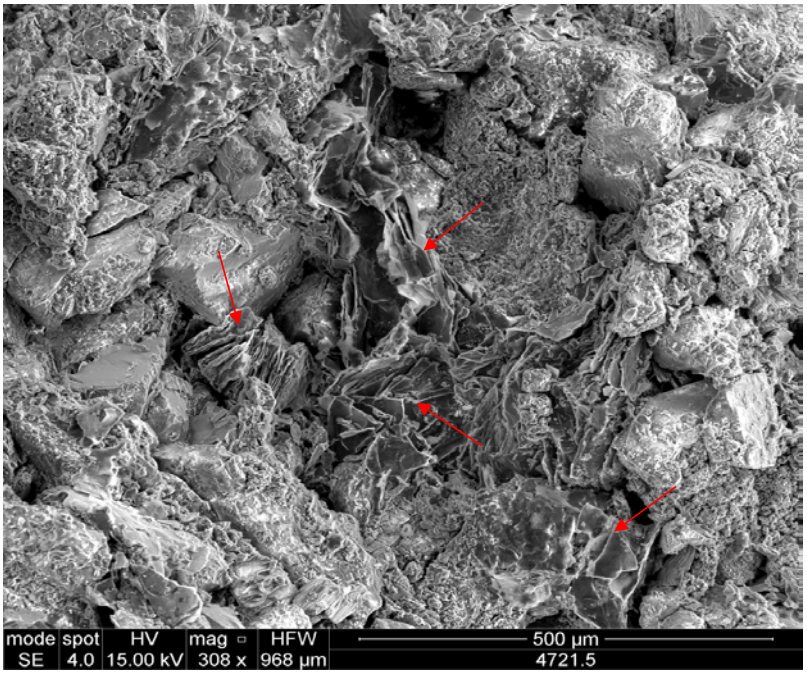
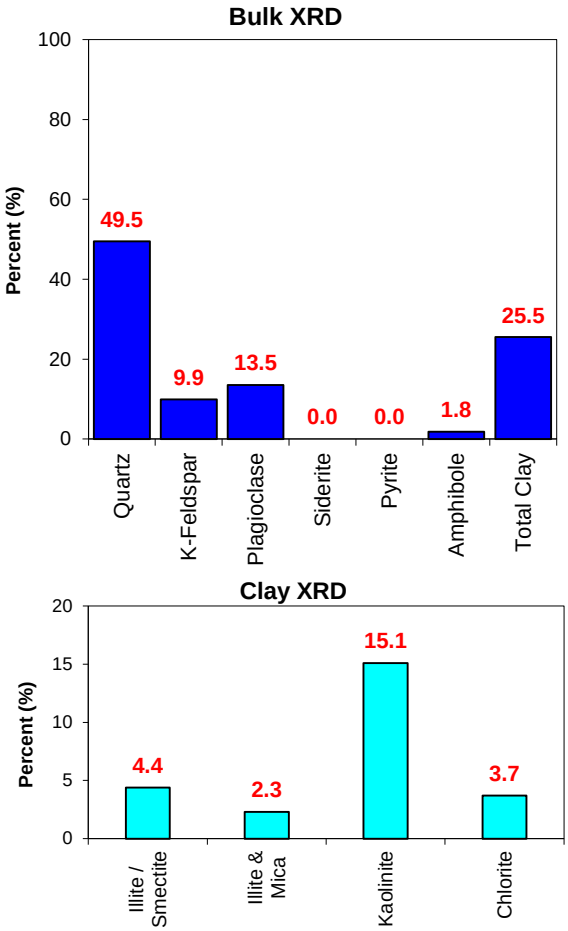


Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

SEM images show that this sample has abundant intergranular pores (P1) and little matrix. Large mica flakes are grain-sized and show crinkles and kinks (red arrows).

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

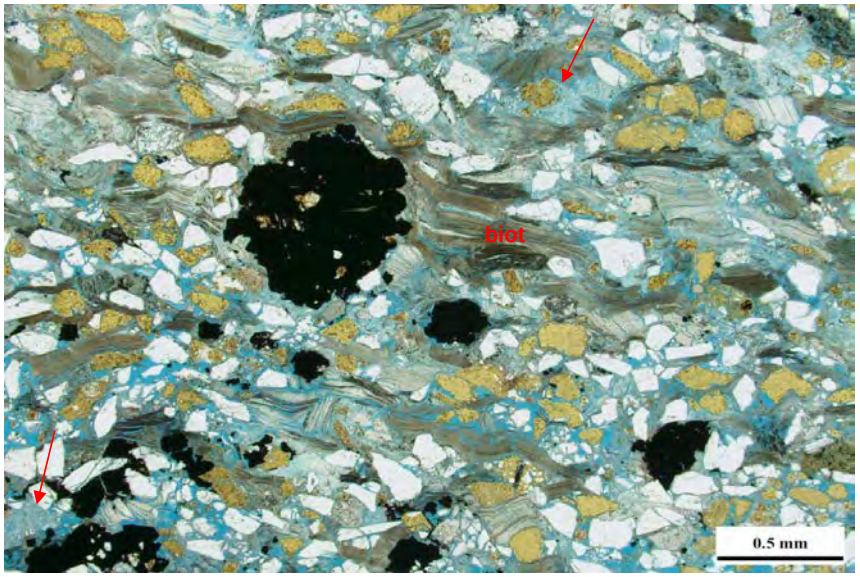
Core Data (nearest adj.):

Porosity (%)*:	33.6
Permeability (md)*:	169.8
Grain Density (g/cc):	2.64

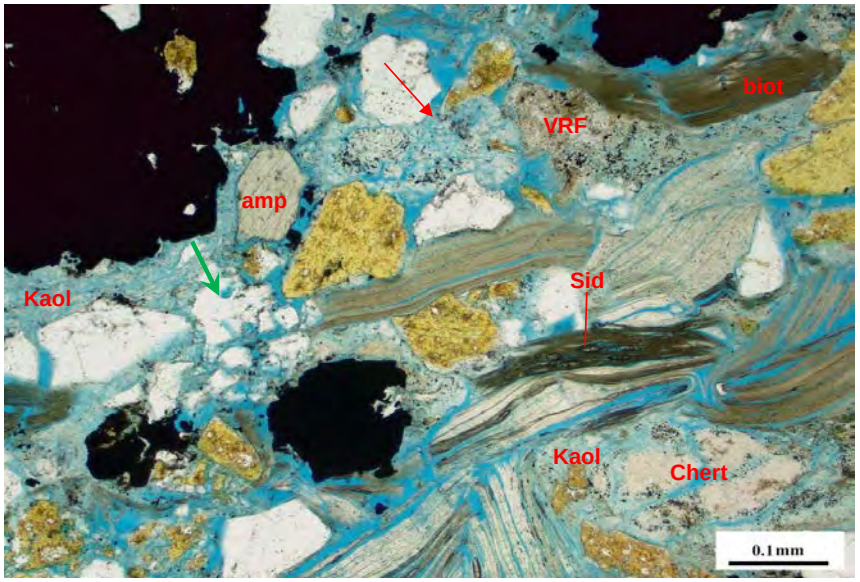
PLATE 2
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4725.50
Sample ID: 79

A PL



B UV



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): fine sand
Sorting: moderate

Structures:
thick parallel lamination defined by well aligned micas within some laminae; clusters of pyrite range from framboids to 1 mm and one patch of pyrite crystals ranges up to 1 cm

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor igneous and metamorphic lithic fragments, rare chert

Other Grains:
common biotite and other mica flakes, minor plant fragments, minor amphibole, minor kaolinite-replaced grains, phosphatic material

Matrix:
none observed

Authigenic minerals:
trace siderite (2-20 micron size crystals) within biotite flakes, moderate kaolinite replacing grains and mica flakes, moderate pyrite

Pore Types:
abundant intergranular pores, minor secondary pores in feldspars, common intercrystal micropores within authigenic kaolinite areas

XRD-Whole Rock Mineralogy (Weight %)

Quartz	44.5	Siderite	0.0
K-Feldspar	13.8	Amphibole	1.6
Plagioclase	8.3	Pyrite	0.5
		Total Clay	31.1

Clay Abundance (Weight %)

Illite / Smectite	2.2	Kaolinite	22.3
Illite & Mica	2.4	Chlorite	4.2

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows the lamination defined by well aligned biotite (biot) and other mica flakes. White grains are mostly quartz. Yellow-stained grains are K-feldspar. Clusters of pyrite (black) occur replacing grains and within pores. Arrows indicate grains that are partially to completely replaced by kaolinite. Photo B shows that kaolinite also occurs as a pore-filling cement (Kaol). Siderite is present in trace amounts as crystals within the sheets of micas (Sid). Amphibole grains and chert grains are also noted. The bluish color of the kaolinite patches indicates intercrystal micropores. Green arrow indicates a plagioclase grains with secondary pores.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	32.0
Permeability (md)*:	465.1
Grain Density (g/cc):	2.71

Core Lab
RESERVOIR OPTIMIZATION

PLATE 2 (cont'd)

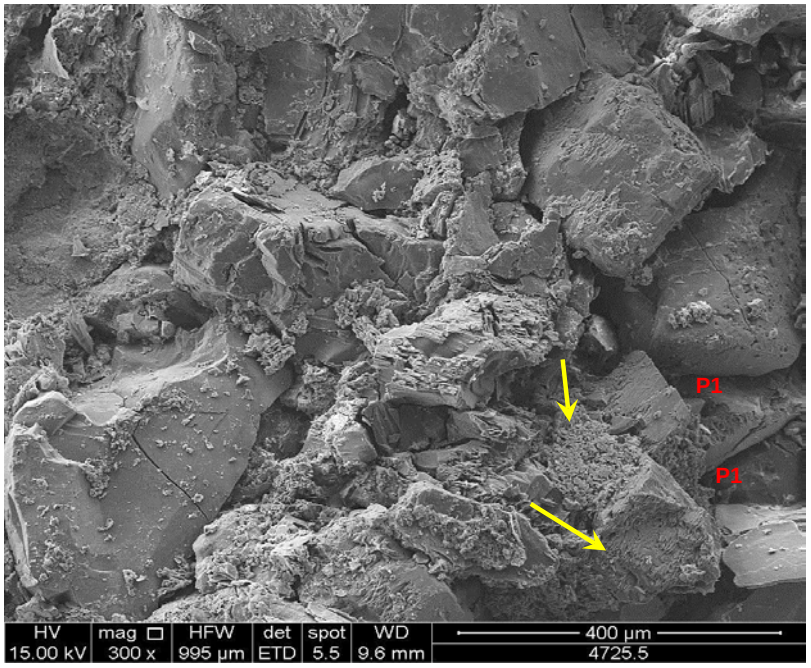
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4725.5
Sample ID: 79

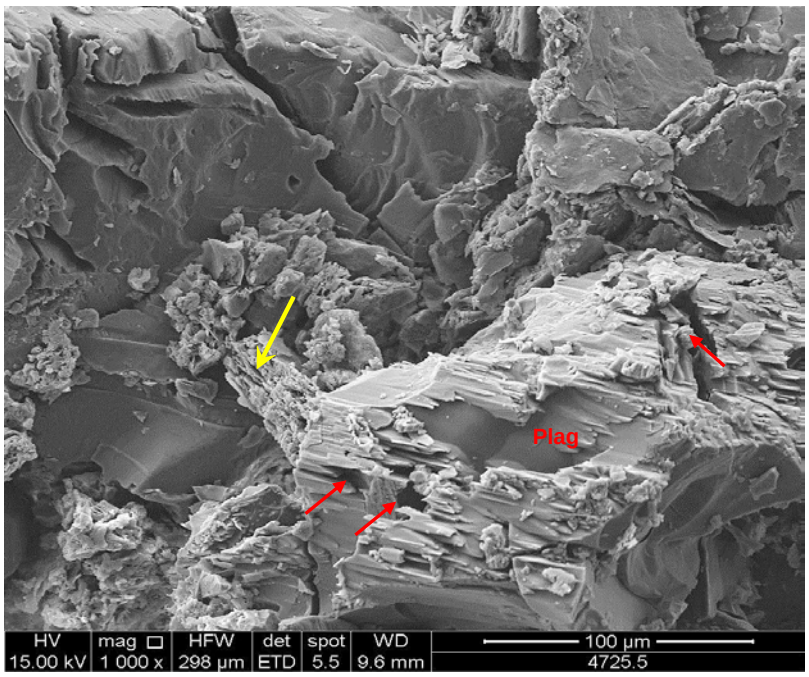
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): fine sand
Sorting: moderate

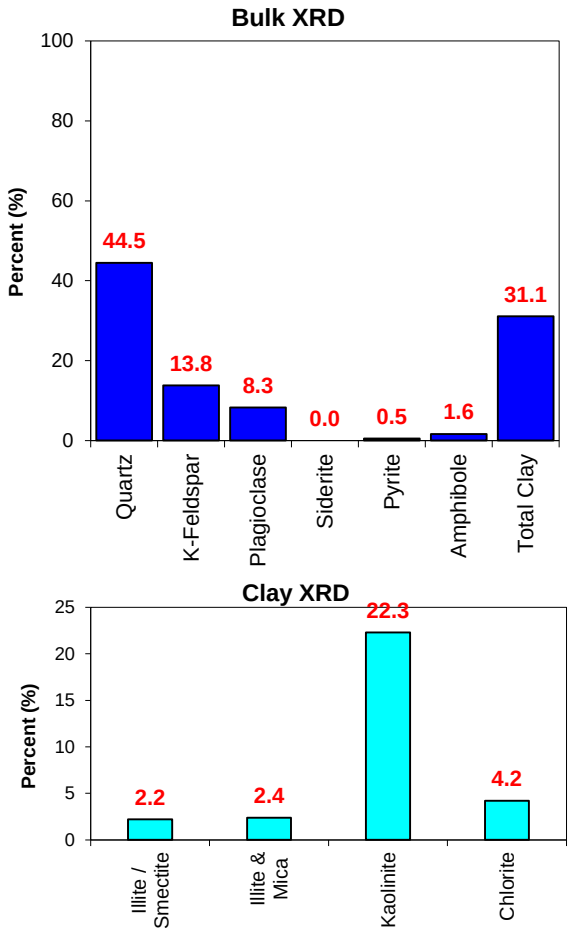
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

SEM images show primary intergranular pores (P1) between rigid framework grains, and secondary dissolution pores (red arrows) within partially dissolved plagioclase (Plag) grains. Kaolinite and kaolinized mica flakes (yellow arrows) are microporous.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	32.0
Permeability (md)*:	465.1
Grain Density (g/cc):	2.71

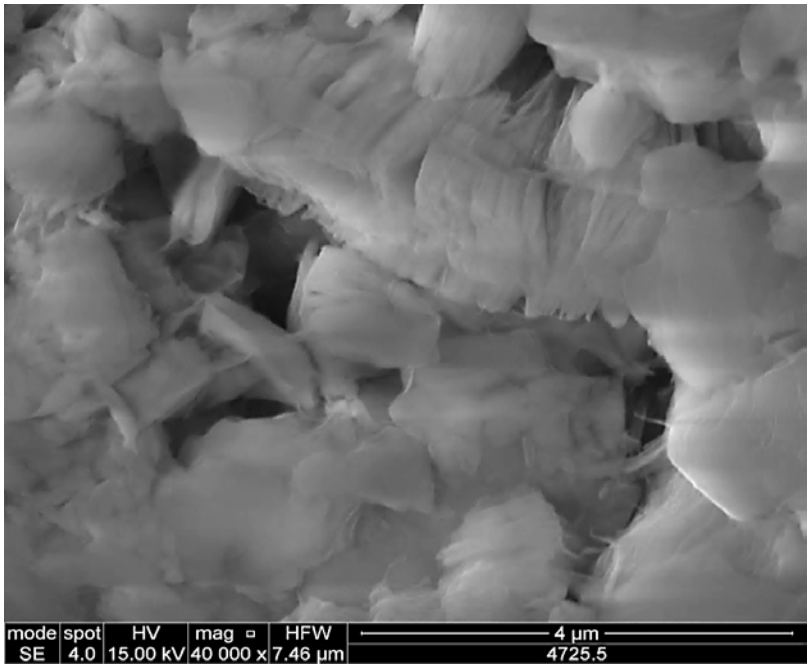
PLATE 2 (cont'd)

Scanning Electron Microscopy

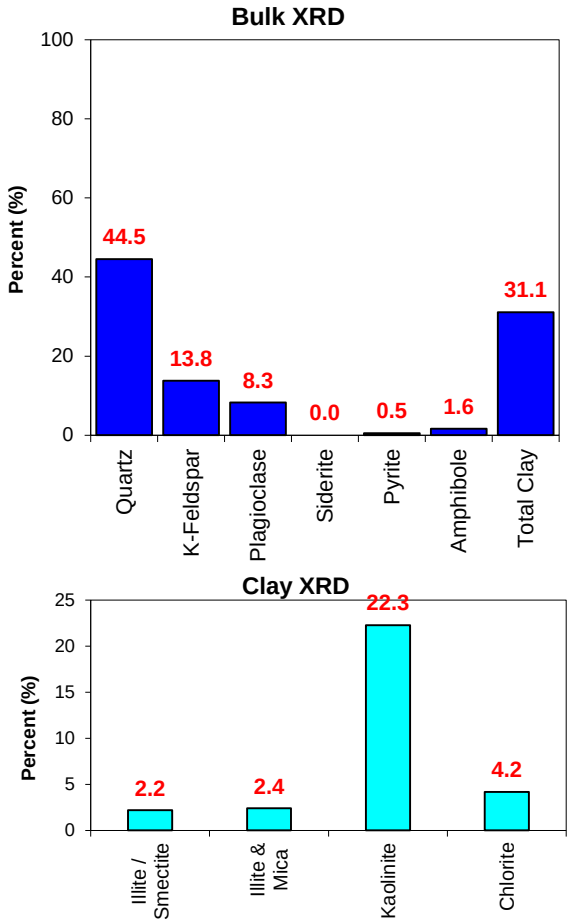
Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4725.5
Sample ID: 79
E

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): fine sand
Sorting: moderate



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

This supplemental SEM image show a very high magnification view of kaolinite booklets that replace grains. Note the intercrystal micropores between kaolinite platelets and vermicular stacks of booklets.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

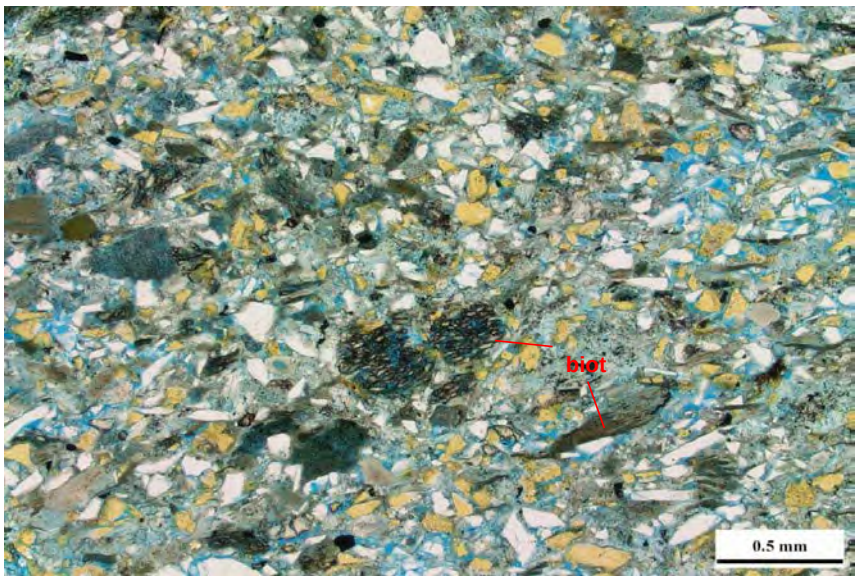
Core Data (nearest adj.):

Porosity (%)*:	32.0
Permeability (md)*:	465.1
Grain Density (g/cc):	2.71

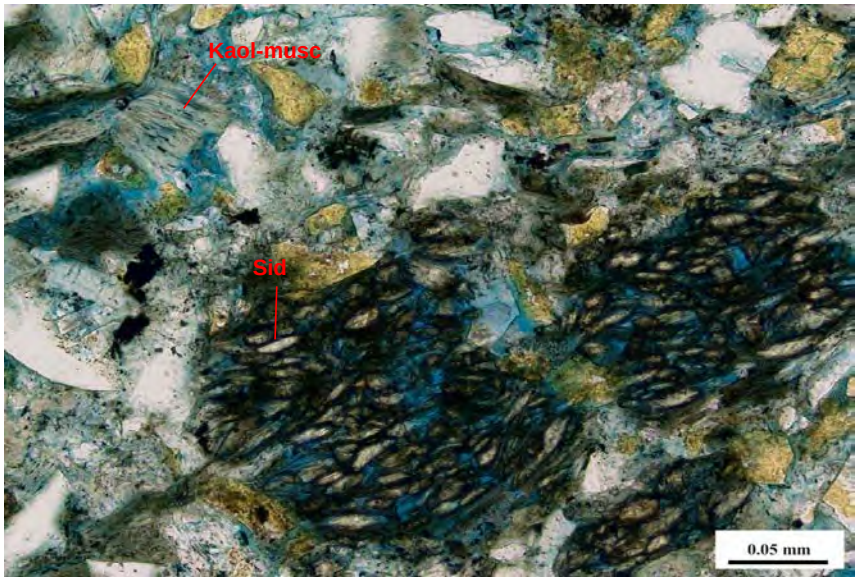
PLATE 3
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4733.50
Sample ID: 87

A PL



B UV



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): silt-very fine sand
Sorting: moderately poor

Structures:
disrupted parallel lamination; aligned micas and slight grain size variations define laminae

Framework Grains:
abundant quartz, moderate K-feldspar and plagioclase, minor igneous and metamorphic lithic fragments, rare chert

Other Grains:
common biotite and other mica flakes, trace zircon, amphibole, sphene

Matrix:
moderate clay (somewhat kaolinized)

Authigenic minerals:
minor siderite associated with biotite flakes (up to 70 micron crystals), moderate kaolinite grain replacement, minor framboidal pyrite

Pore Types:
moderate intergranular pores, minor intragranular pores, moderate kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	38.8	Siderite	2.6
K-Feldspar	9.9	Amphibole	0.0
Plagioclase	6.9	Pyrite	0.0
		Total Clay	41.9

Clay Abundance (Weight %)

Illite / Smectite	8.3	Kaolinite	27.3
Illite & Mica	2.6	Chlorite	3.7

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This sample has the finest grain size among the sample suite. Muscovite flakes show common replacement by kaolinite (Kaol-musc), and kaolinite fills intergranular areas. Biotite flakes (biot) range from unaltered to "splayed-open" and are host to lozenge-shaped siderite crystals (Sid). Rigid framework grains include abundant quartz and plagioclase (white) and moderate K-feldspar (stained yellow).

Core Lab
RESERVOIR OPTIMIZATION

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	31.9
Permeability (md)*:	23
Grain Density (g/cc):	2.67

PLATE 3 (cont'd)

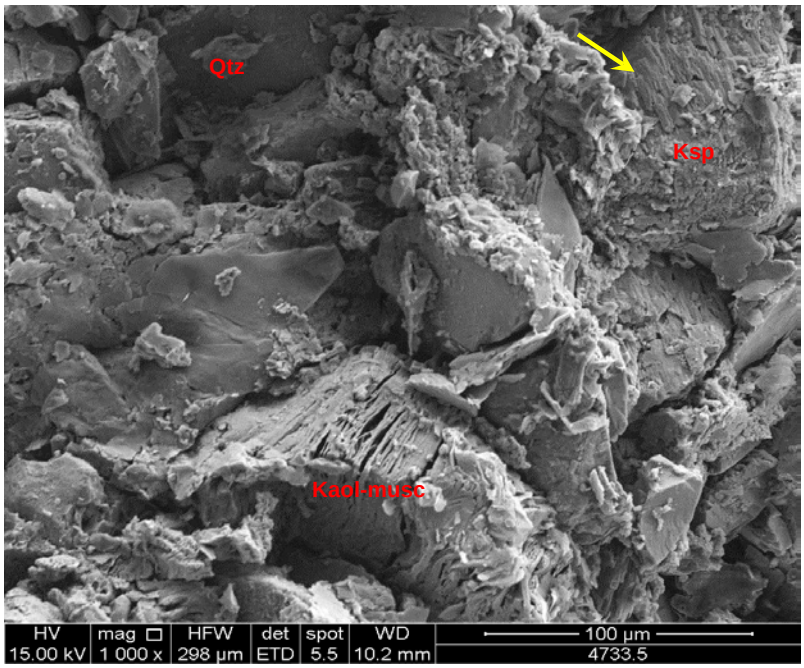
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4733.5
Sample ID: 87

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): silt-very fine sand
Sorting: moderately poor

C



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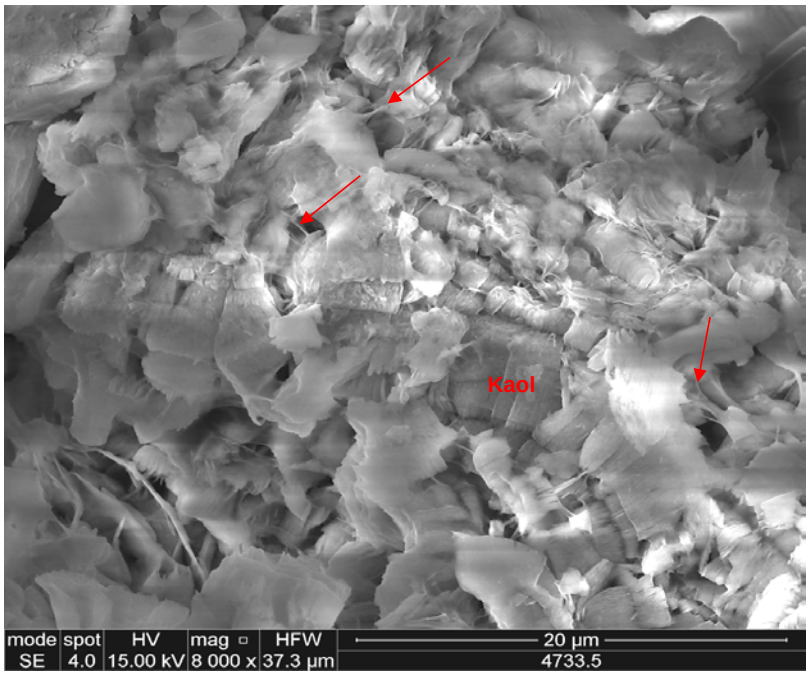
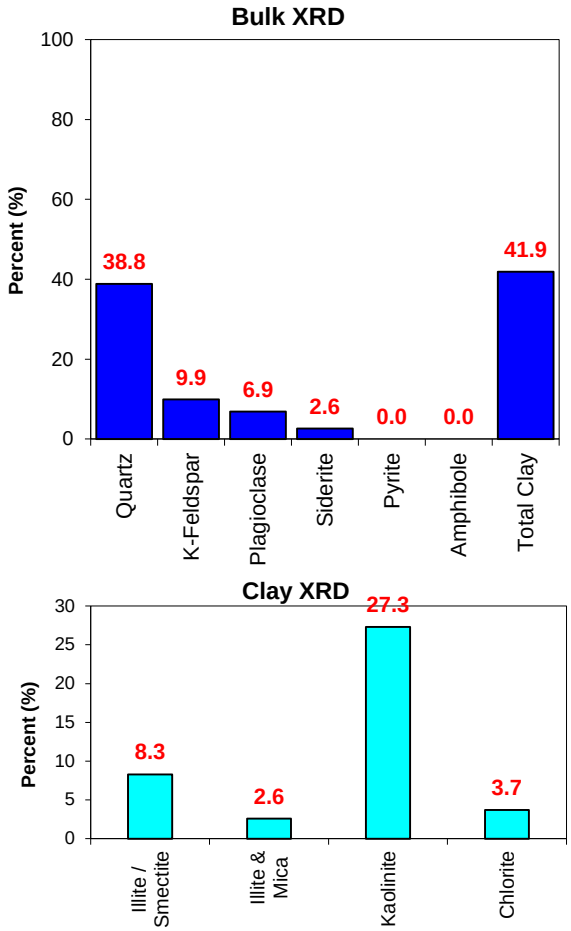


Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

SEM images show detrital quartz (Qtz) and K-feldspar (Ksp) grains, and large detrital micas such as muscovite that is converting to kaolinite (Kaol-musc). The K-feldspar grains shows traces of partial authigenic overgrowths (yellow arrow). Elsewhere in the sample, densely packed curved vermicular stacks of kaolinite (Kaol) replace grains and fill pores. Intercrystal micropores between kaolinite platelets are partially cemented by webby stringers of micropore-bridging mixed-layer illite/smectite (red arrows). Intercrystal micropores within the abundant kaolinite contributes greatly to the measured porosity in the sample.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

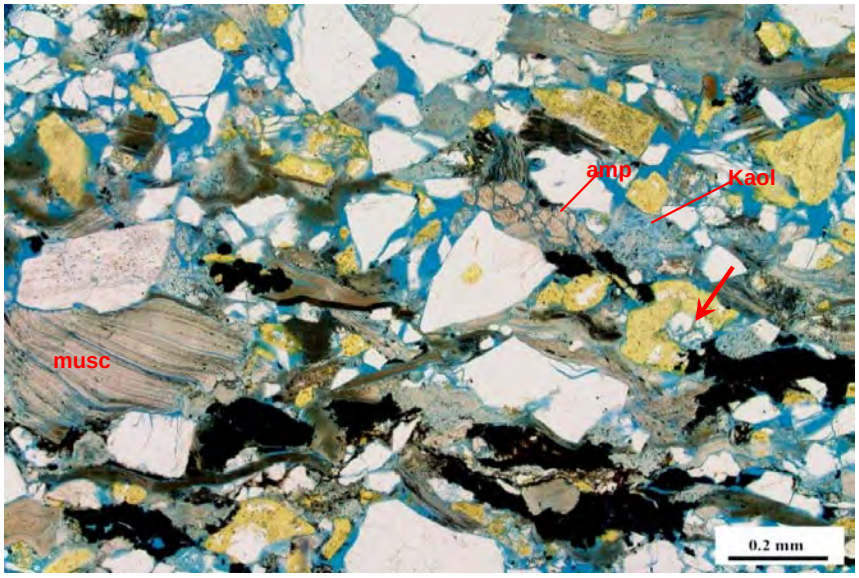
Core Data (nearest adj.):

Porosity (%)*:	31.9
Permeability (md)*:	23
Grain Density (g/cc):	2.67

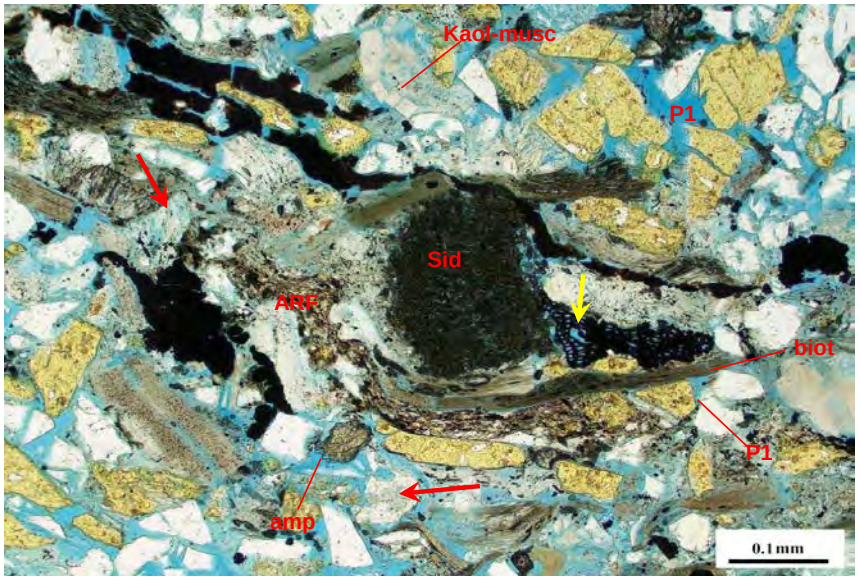
PLATE 4
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4755.50
Sample ID: 109

A PL



B UV



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): very fine-medium sand
Sorting: poor

Structures:
size-sorted laminae (medium sand, very fine sand), and micaceous or planty laminae

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert and silty mudstone fragments

Other Grains:
common biotite and muscovite flakes, moderate plant fragments, trace zircon, amphibole, sphene, epidote

Matrix:
none observed

Authigenic minerals:
minor siderite associated with biotite flakes, moderate kaolinite grain replacement, minor framboidal pyrite

Pore Types:
moderate intergranular pores, minor intragranular pores, moderate kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	43.9	Siderite	2.2
K-Feldspar	13.6	Amphibole	0.0
Plagioclase	11.2	Pyrite	1.0
		Total Clay	28.1

Clay Abundance (Weight %)

Illite / Smectite	3.2	Kaolinite	17.7
Illite & Mica	4.2	Chlorite	3.0

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This sandstone is characterized by distinctive micaceous and planty laminae. Plant fragments are the dark brown-black, irregular-elongate particles in these photomicrographs. One fragment exhibits distinctive cellular structure (yellow arrow). Sand-size flakes of biotite (biot) and muscovite (musc) are also aligned in laminae. Some muscovite flakes are partly replaced by kaolinite (Kaol-musc). Blue epoxy fills intergranular pores (P1). Patches of grain-replacing kaolinite (Kaol) are faint blue, indicating the presence of intercrystal micropores between kaolinite booklets. Some of the plagioclase grains show intragranular dissolution pores (red arrows). Siderite (Sid) occurs associated with biotite flakes. Scattered amphibole grains (amp) are noted. The argillaceous fragments (ARF) is highly deformed.

Core Lab
RESERVOIR OPTIMIZATION

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	32.7
Permeability (md)*:	1475.7
Grain Density (g/cc):	2.66

PLATE 4 (cont'd)

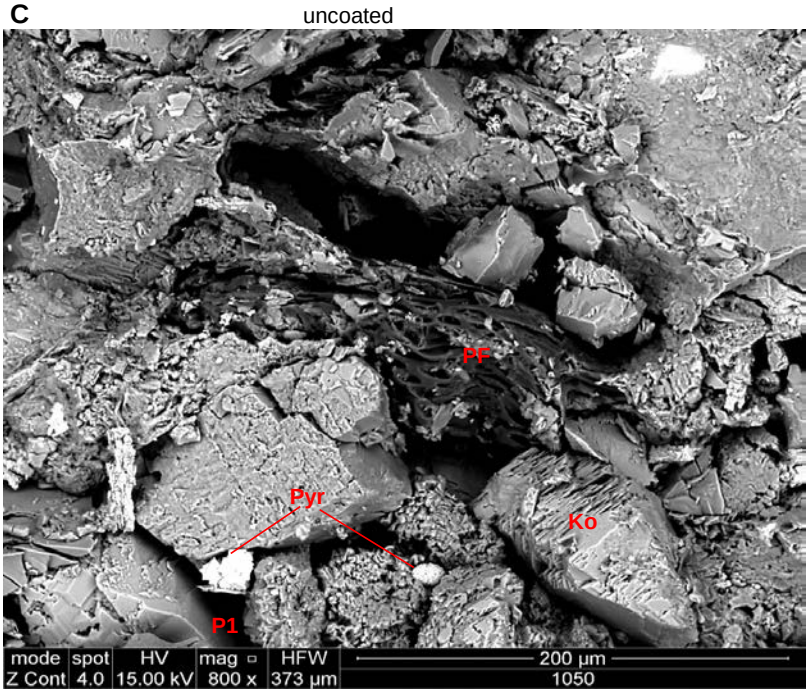
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4755.5
Sample ID: 109

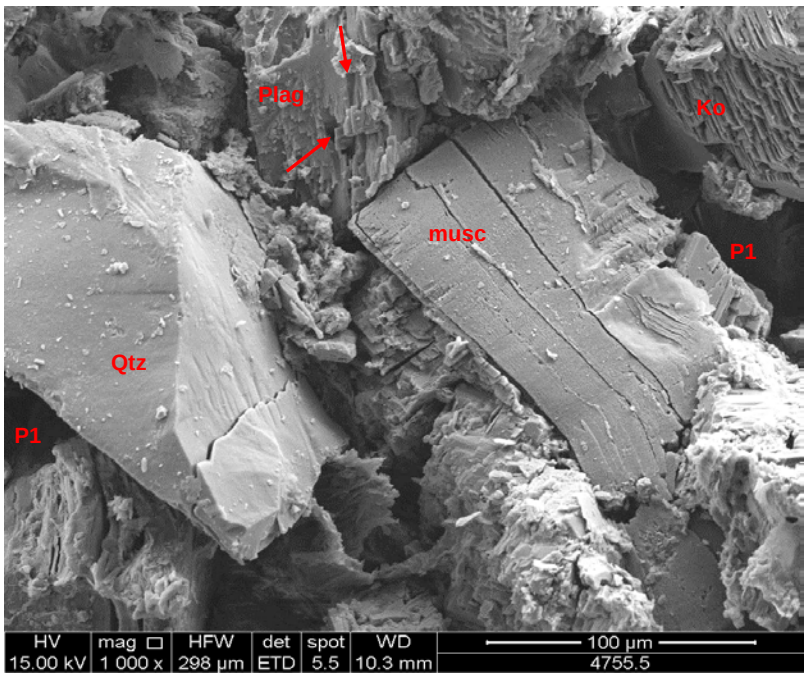
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): very fine-medium sand
Sorting: poor

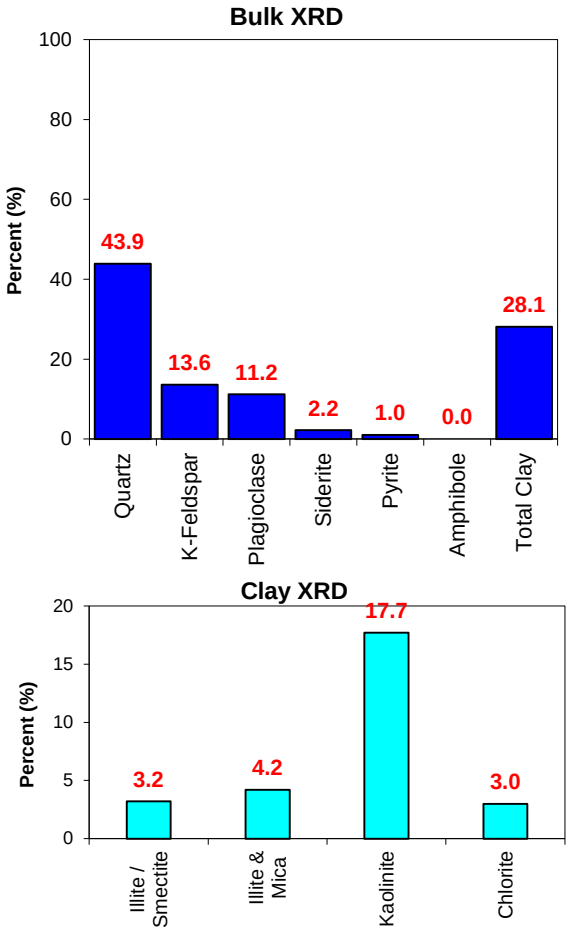
C uncoated



D coated



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

Using backscatter mode, (Photo C) the carbon that makes up a plant fragment (PF) appears dark (low molecular weight), whereas the iron in pyrite framboids (Pyr) appears bright white (high molecular weight). Grey tones in the image correspond to siliciclastic grains. An overgrowth is visible on K-feldspar (Ko). The plant fragment has a distinctive cellular structure. A standard SEM (Photo D) shows abundant intergranular pores (P1) between rigid quartz (Qtz), K-feldspar, and plagioclase (Plag) grains. Dissolution pores (red arrows) occur within the plagioclase grains. Many K-feldspar grains exhibit authigenic overgrowths (Ko). EDX analysis of the mica flake suggests that it is muscovite.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

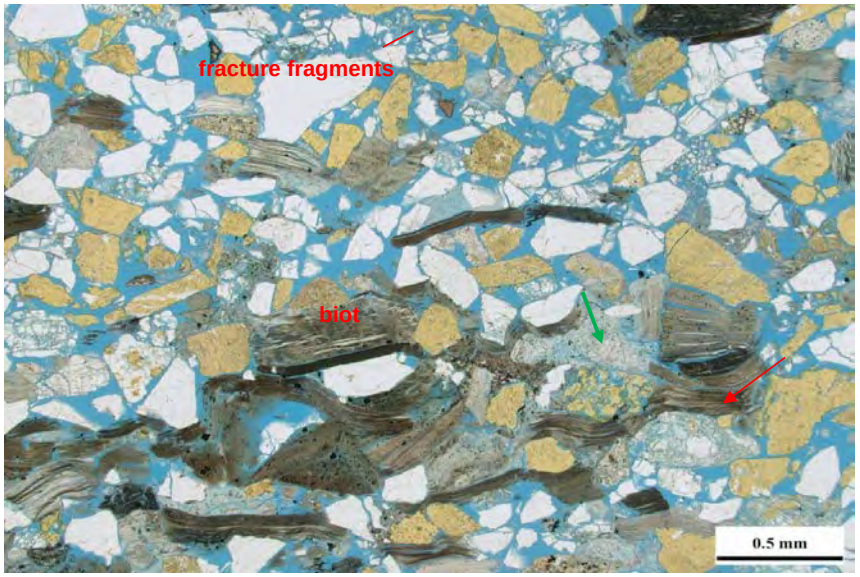
Core Data (nearest adj.):

Porosity (%)*:	32.7
Permeability (md)*:	1475.7
Grain Density (g/cc):	2.66

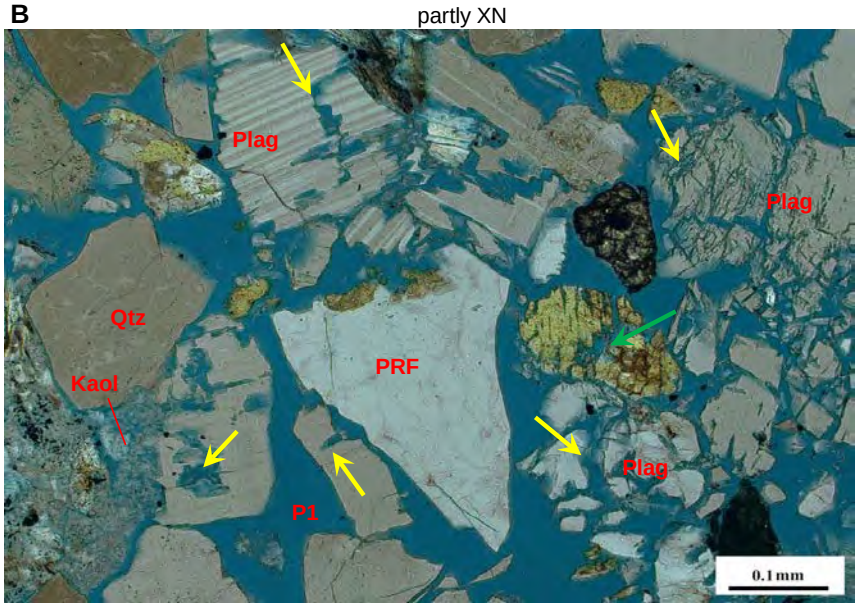
PLATE 5
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4757.50
Sample ID: 111

A PL



B partly XN



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: well

Structures:
thick parallel lamination defined by aligned micaceous laminae

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert

Other Grains:
common biotite flakes, minor sphene, trace amphibole

Matrix:
none observed

Authigenic minerals:
kaolinite replacement of mica flakes, trace pyrite framboids

Pore Types:
moderate intergranular pores, minor intragranular pores, moderate kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	52.3	Siderite	0.0
K-Feldspar	12.2	Amphibole	1.4
Plagioclase	11.1	Pyrite	0.7
		Total Clay	22.3

Clay Abundance (Weight %)

Illite / Smectite	2.2	Kaolinite	14.3
Illite & Mica	3.7	Chlorite	2.1

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This medium-grained sandstone exhibits thick laminae defined by varying mica content (Photo A). Laminae with micas probably reflect the true fabric compared to areas with a lot of fractured grains (upper half; Photo A). Areas with many fractured grains actually include numerous disrupted partly dissolved plagioclase (Plag) grains Photo B). Yellow arrows designate secondary pores within the plagioclase grains. K-feldspar grains also shows intragranular dissolution pores (green arrows), and red arrow (Photo A) shows intragranular pores in a lithic fragment. Some of the intergranular areas are undoubtedly primary pores (P1) but the presence of dislodged plagioclase dissolution remnants and fracture fragments make the determination difficult. Quartz (Qtz) grains or in quartz in plutonic lithic fragments (PRF) shows no dissolution. Minor intergranular kaolinite is noted (Kaol).

Core Lab
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Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	34.9
Permeability (md)*:	3709.7
Grain Density (g/cc):	2.65

PLATE 5 (cont'd)

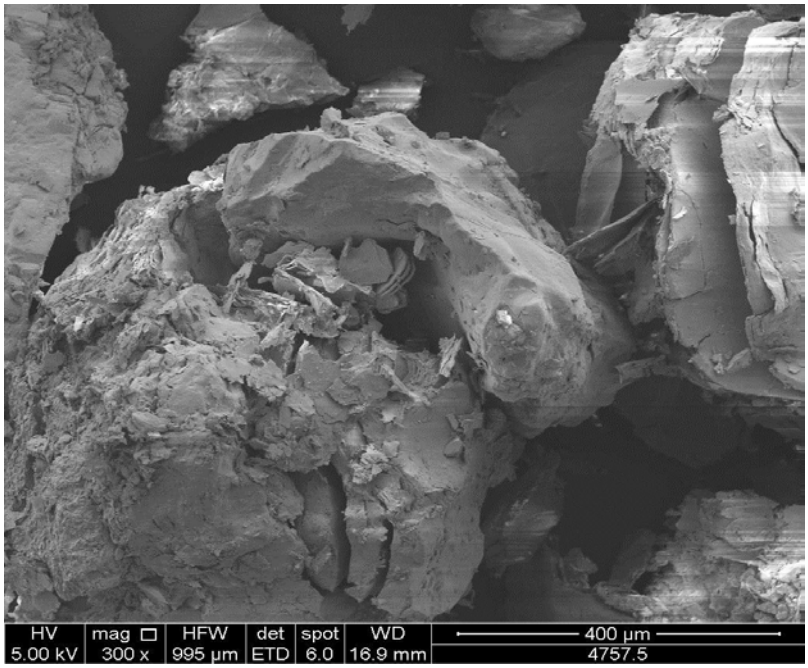
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4757.5
Sample ID: 111

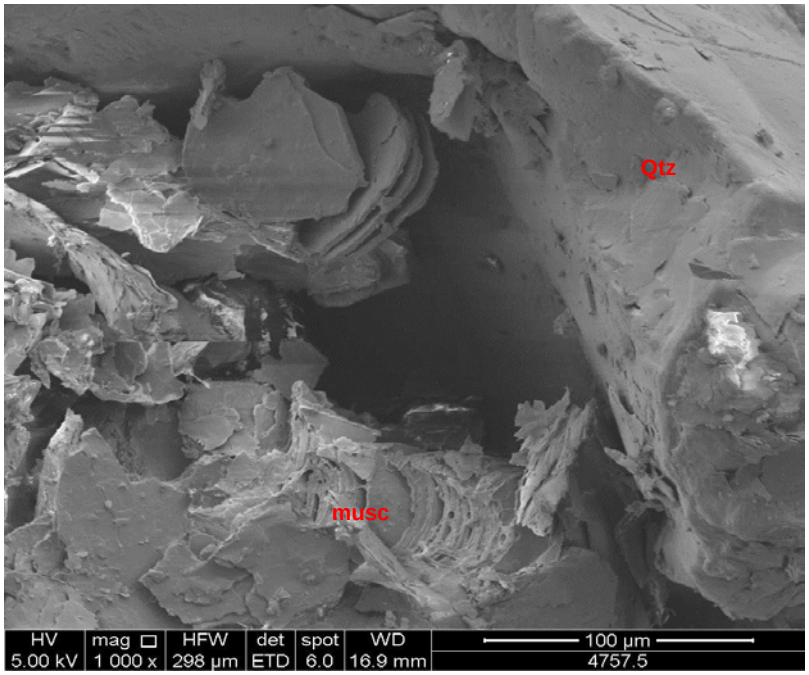
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: well

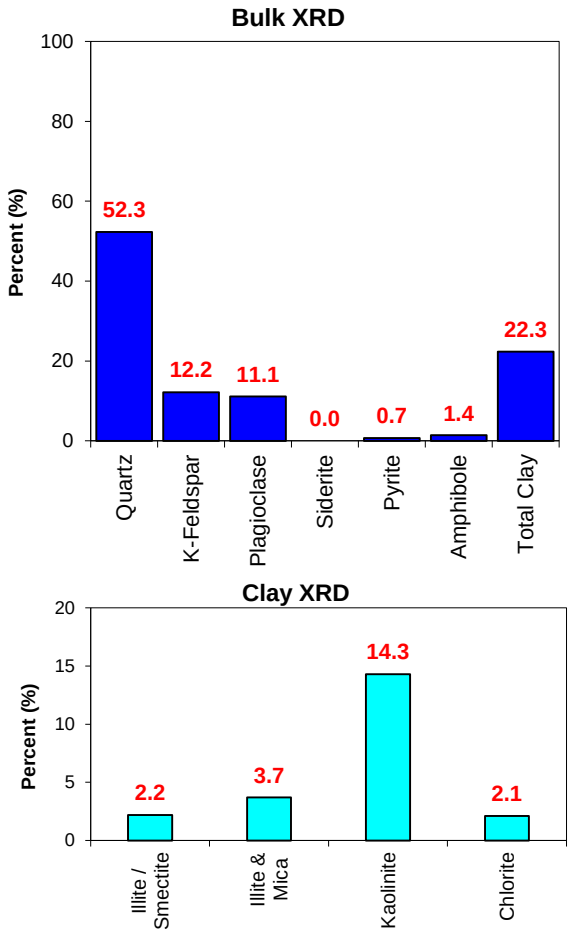
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

The loose grains that make up this SEM sample show no grain-coating or authigenic cement. Grains identified using EDS analysis include quartz (Qtz) and muscovite (musc). Pores represented in the images are not representative.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

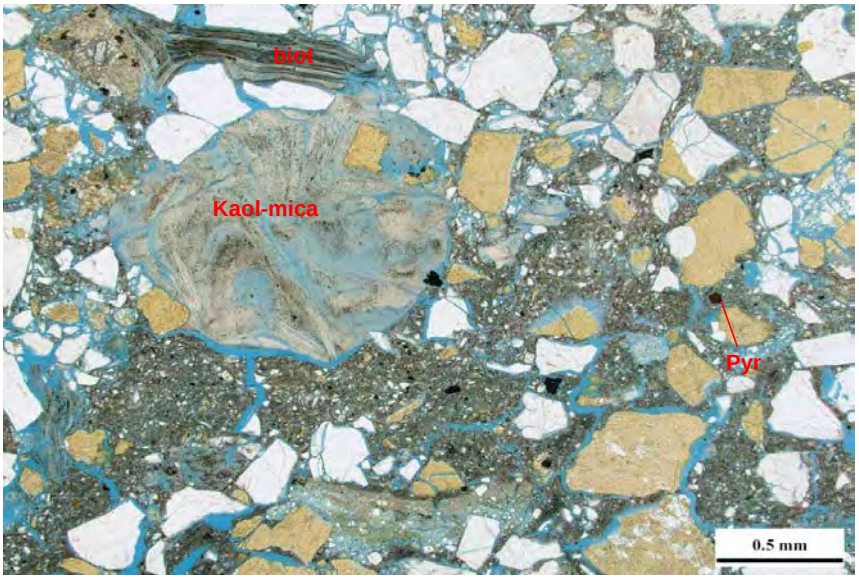
Core Data (nearest adj.):

Porosity (%)*:	34.9
Permeability (md)*:	3709.7
Grain Density (g/cc):	2.65

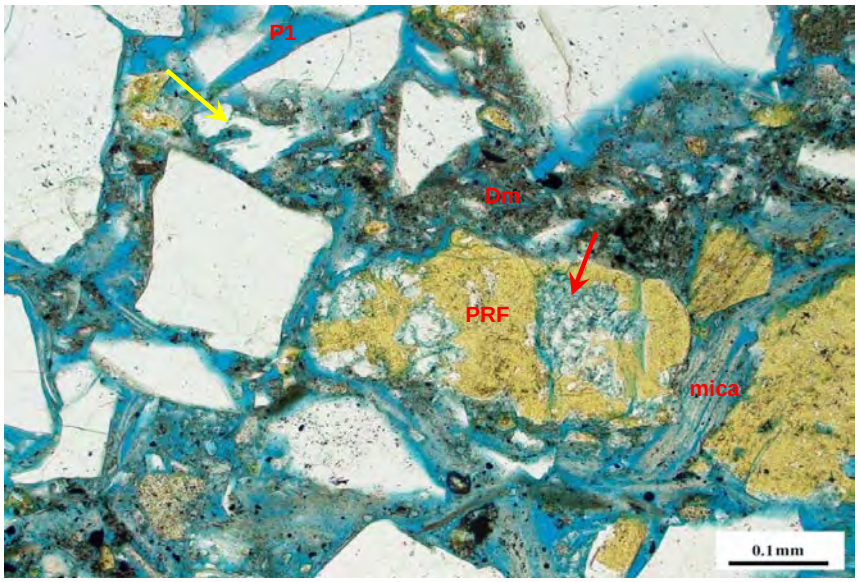
PLATE 6
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4763.50
Sample ID: 117

A PL



B UV



Sample Description

Lithology: sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium-coarse sand
Sorting: moderately poor

Structures:
massive; coring damage; argillaceous areas

Framework Grains:
abundant quartz including minor polycrystalline quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert

Other Grains:
common biotite flakes, minor sphene, trace amphibole

Matrix:
minor-moderate clay (significantly kaolinized)

Authigenic minerals:
kaolinite replacement of mica flakes, trace pyrite framboids

Pore Types:
minor intergranular pores, minor intragranular pores, kaolinite intercrystal micropores, matrix micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	64.5	Siderite	0.0
K-Feldspar	14.3	Amphibole	0.0
Plagioclase	4.9	Pyrite	0.0
		Total Clay	16.2

Clay Abundance (Weight %)

Illite / Smectite	2.6	Kaolinite	9.6
Illite & Mica	2.1	Chlorite	1.9

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows one of the argillaceous areas of this thin section. Detrital matrix (Dm) surrounds the poorly sorted quartz, plagioclase (white), K-feldspar (stained yellow), and plutonic lithic fragments (PRF; white and yellow). Sand-size detrital biotite (biot) and kaolinized micas (Kaol-mica) are present. Pore types include intergranular (P1), intragranular pores in plagioclase (yellow arrow), and intragranular pores in plutonic lithic fragments (red arrow). The blue coloration of the kaolinized mica flake suggests that it is slightly microporous.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	33.9
Permeability (md)*:	4345.4
Grain Density (g/cc):	2.63

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PLATE 6 (cont'd)

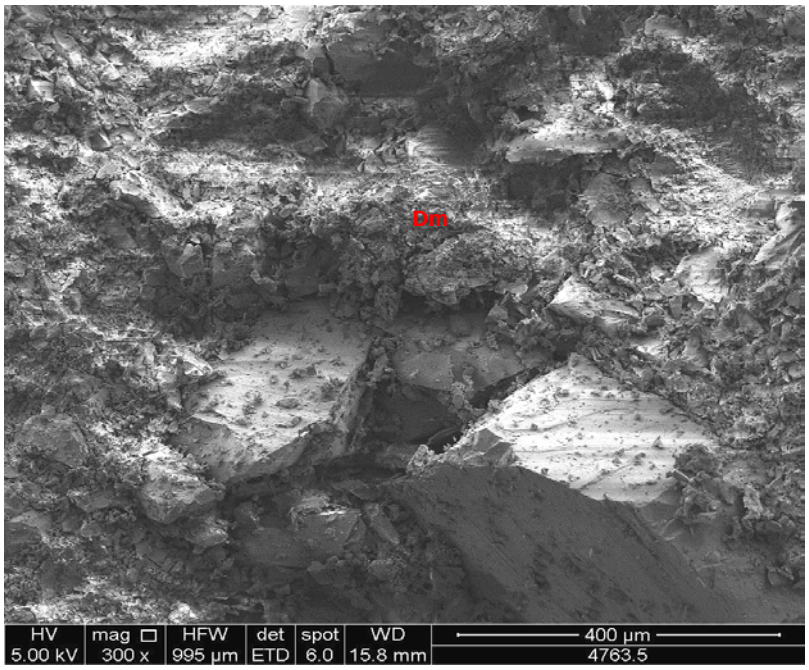
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4763.5
Sample ID: 117

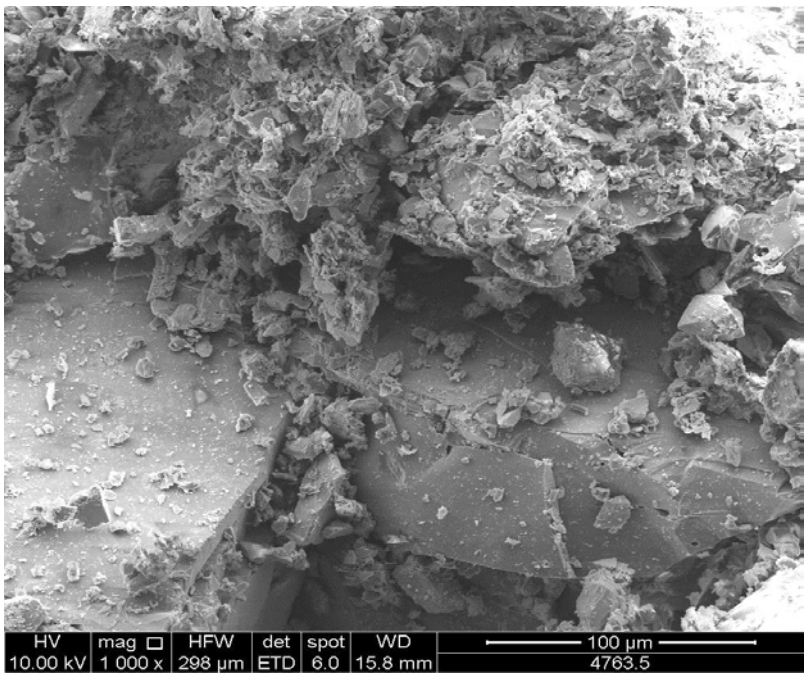
Lithology: sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium-coarse sand
Sorting: moderately poor

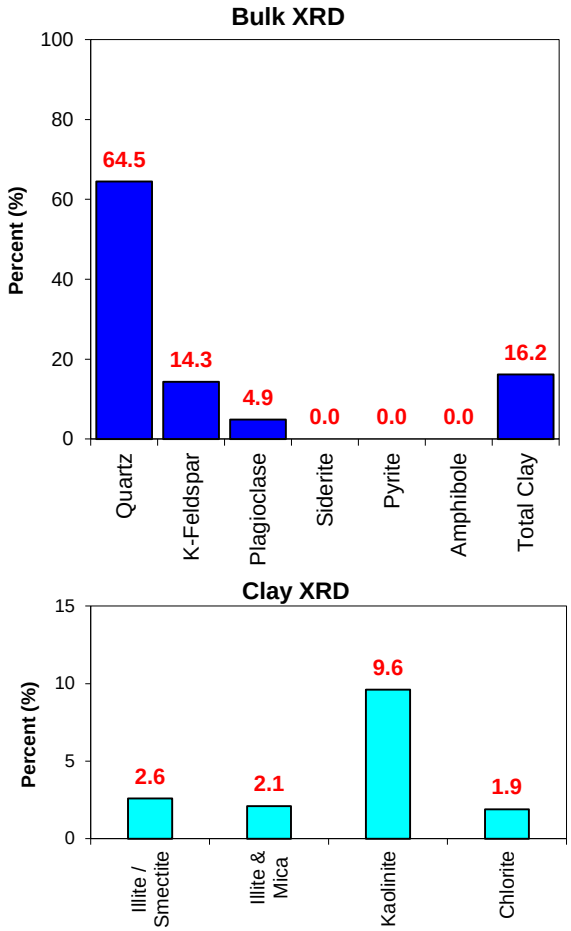
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

SEM images of the sample show a part of the sandstone that contains abundant detrital matrix (Dm). Grains are angular and may be fractured. Matrix micropores are present.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

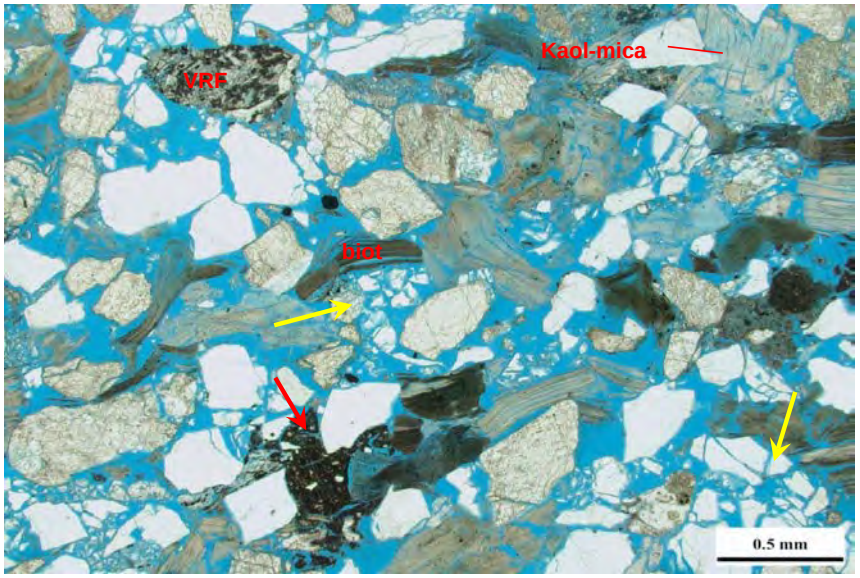
Core Data (nearest adj.):

Porosity (%)*:	33.9
Permeability (md)*:	4345.4
Grain Density (g/cc):	2.63

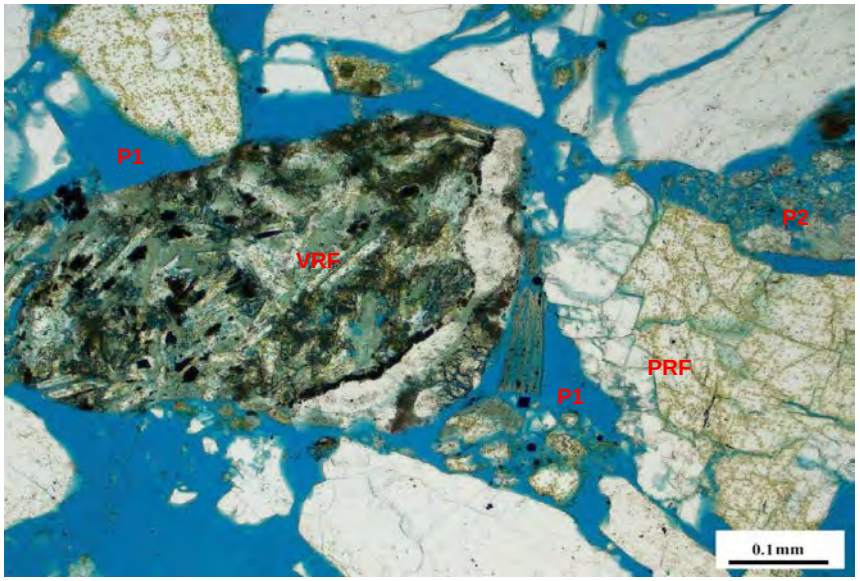
PLATE 7
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4765.50
Sample ID: 119

A PL



B



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium-coarse sand
Sorting: moderately well

Structures:
massive; sample shows great coring dilation and grain fracturing

Framework Grains:
abundant quartz, minor polycrystalline quartz, moderate K-feldspar, minor plagioclase, minor plutonic, volcanic, and metamorphic lithic fragments, rare chert

Other Grains:
common biotite, minor muscovite, trace silty rip-up clasts, trace amphibole, and opaque minerals

Matrix:
none observed

Authigenic minerals:
kaolinite replacement of mica flakes, trace pyrite framboids

Pore Types:
probable abundant intergranular pores, moderate intragranular pores in feldspar

XRD-Whole Rock Mineralogy (Weight %)

Quartz	56.3	Siderite	0.0
K-Feldspar	9.3	Amphibole	0.9
Plagioclase	4.2	Pyrite	0.0
		Total Clay	29.2

Clay Abundance (Weight %)

Illite / Smectite	1.7	Kaolinite	16.3
Illite & Mica	6.6	Chlorite	4.6

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows the highly dilated massive fabric of this sandstone. Many clusters of grain fragments (yellow arrows) are actually slightly dilated partly dissolved plagioclase grains. Rarely observed grains include a volcanic rock fragment (VRF) and a deformed argillaceous rip-up (red arrow). Sand-size biotite and kaolinized mica flakes (Kaol-mica) are also noted. The featured volcanic rock fragment in Photo B shows faint intragranular micropores. Possible primary intergranular pores are noted (P1). The plutonic lithic fragment (PRF) is slightly fractured. Intragranular pores (P2) are noted in another lithic fragment.

Core Lab
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Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	35.4
Permeability (md)*:	4760.9
Grain Density (g/cc):	2.62

PLATE 7 (cont'd)

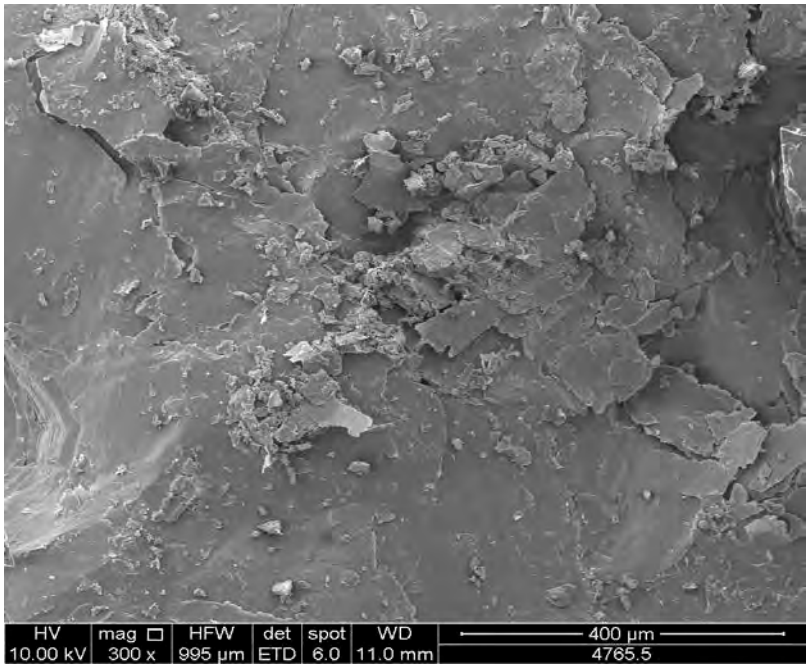
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4765.5
Sample ID: 119

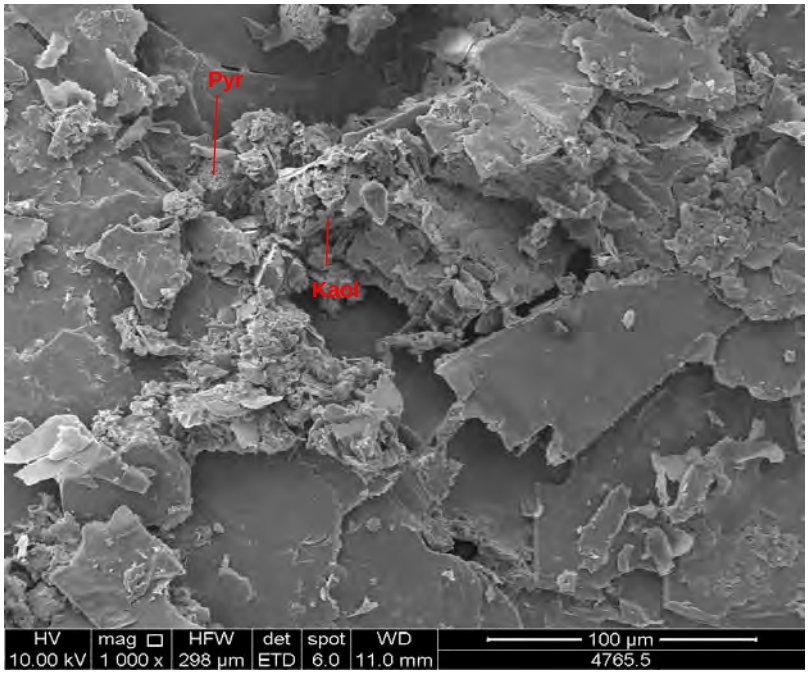
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium-coarse sand
Sorting: moderately well

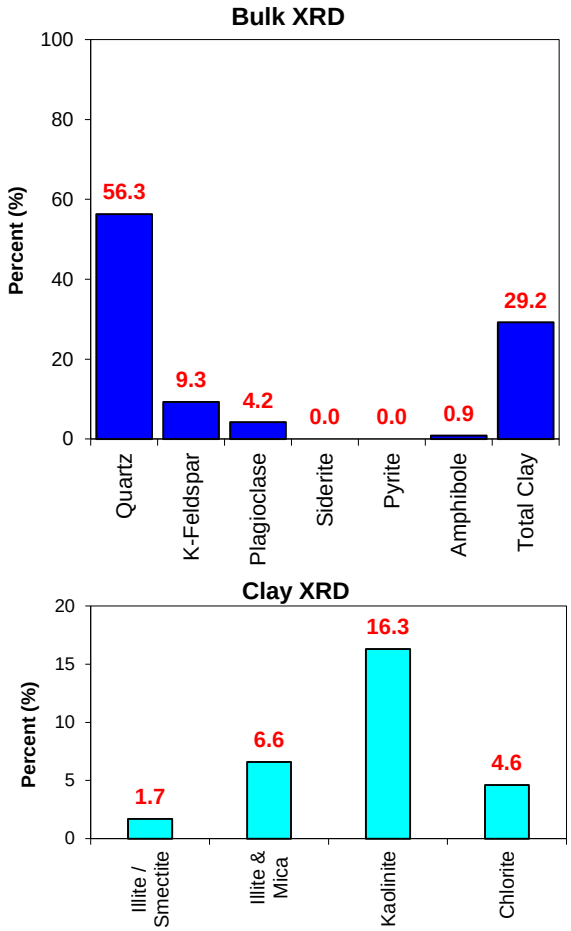
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

The surface of this mica flake shows traces of patchy kaolinization (Kaol). Minute framboidal pyrite is also observed (Pyr).

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

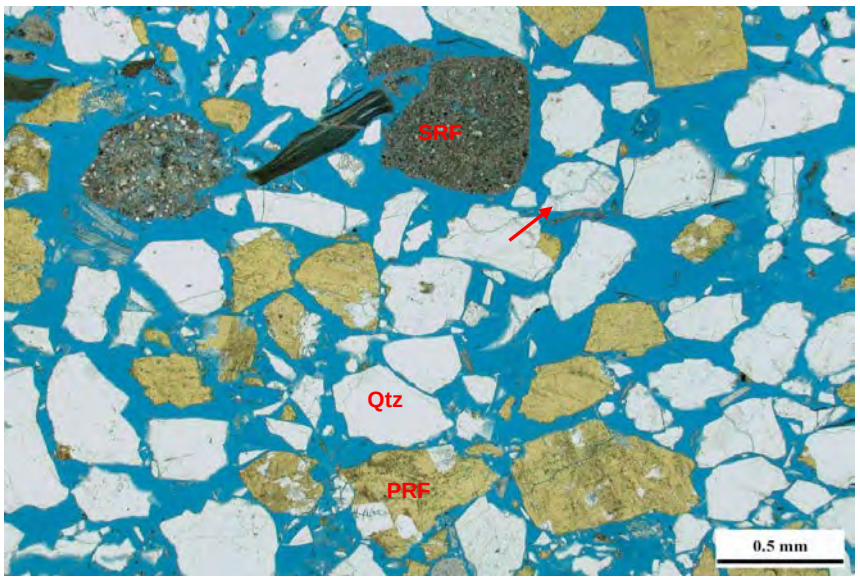
Core Data (nearest adj.):

Porosity (%)*:	35.4
Permeability (md)*:	4760.9
Grain Density (g/cc):	2.62

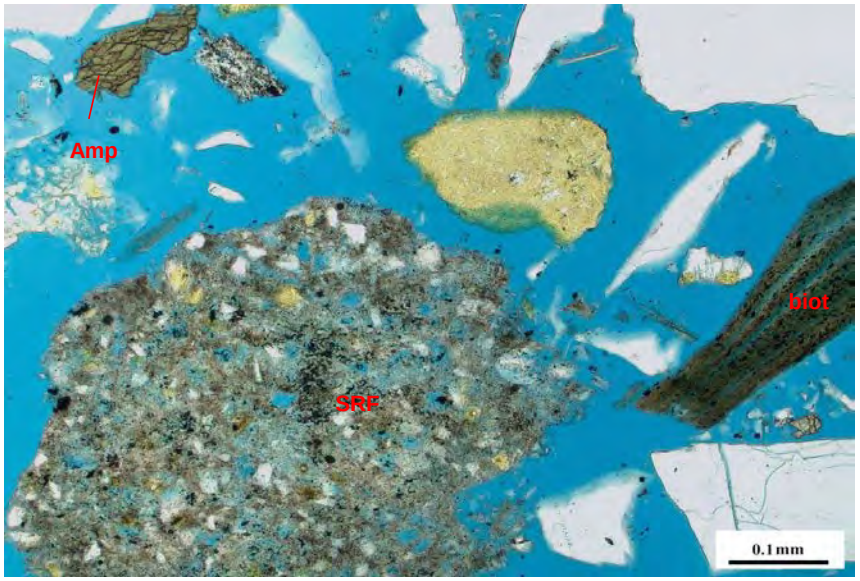
PLATE 8
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4770.50
Sample ID: 124

A PL



B UV



Sample Description

Lithology: sandstone

Classif. (Folk, 1980): subarkose
Grain Size (range): coarse sand
Sorting: well

Structures:
homogeneous, massive; coring dilation

Framework Grains:
abundant quartz, moderate K-feldspar, minor plagioclase, moderate plutonic lithic fragments, minor volcanic and metamorphic fragments, rare chert and siltstone

Other Grains:
minor biotite and muscovite flakes, trace sphene, epidote, amphibole

Matrix:
none observed

Authigenic minerals:
kaolinite replacement of mica flakes, trace pyrite framboids

Pore Types:
probable abundant intergranular pores, moderate intragranular pores in feldspar

XRD-Whole Rock Mineralogy (Weight %)

Quartz	77.4	Siderite	0.0
K-Feldspar	8.7	Amphibole	0.0
Plagioclase	4.4	Pyrite	0.0
		Total Clay	9.5

Clay Abundance (Weight %)

Illite / Smectite	0.9	Kaolinite	5.8
Illite & Mica	1.6	Chlorite	1.2

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows the highly dilated fabric of this sample. Small angular fragments are chips of fractured grains (coring damage). Identified grains include quartz (Qtz), plutonic lithic fragments (PRF), sedimentary rock fragments (SRF), and a plagioclase grain with faint cleavage traces visible (red arrow). In Photo B, a silty sedimentary rock fragment shows intraparticle micropores. Biotite (biot) and amphibole (Amp) are also identified.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	36.3
Permeability (md)*:	13197.8
Grain Density (g/cc):	2.63

Core Lab
RESERVOIR OPTIMIZATION

PLATE 8 (cont'd)

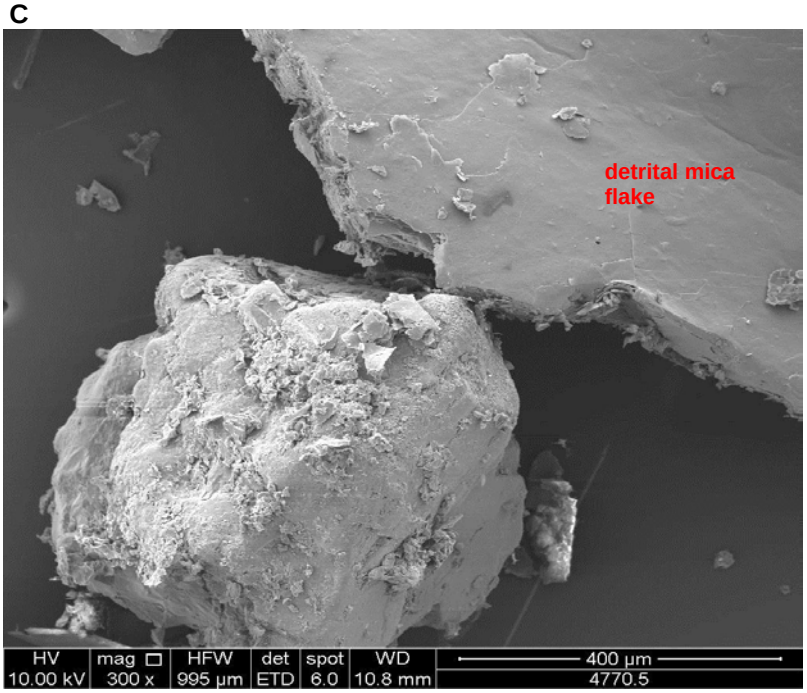
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4770.5
Sample ID: 124

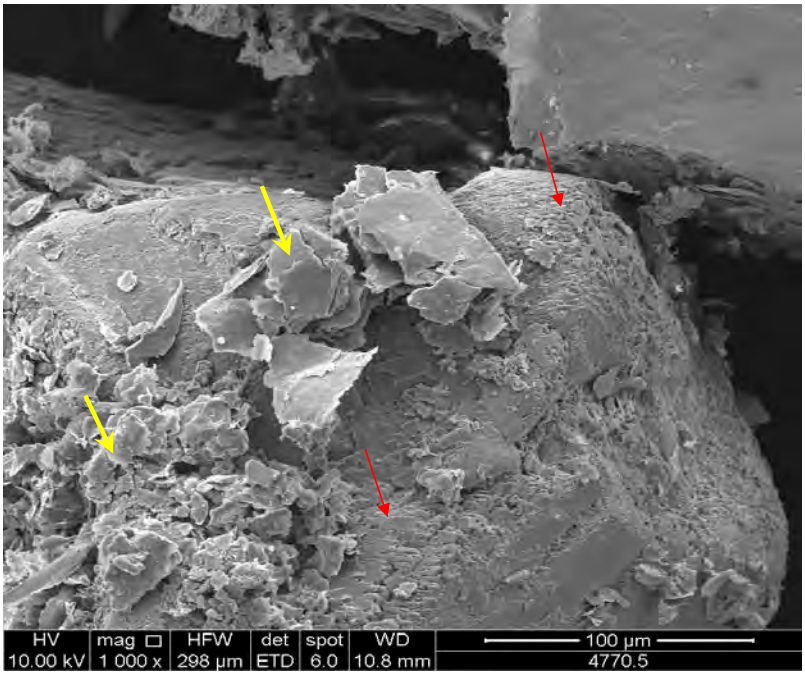
Lithology: sandstone

Classif. (Folk, 1980): subarkose
Grain Size (range): coarse sand
Sorting: well

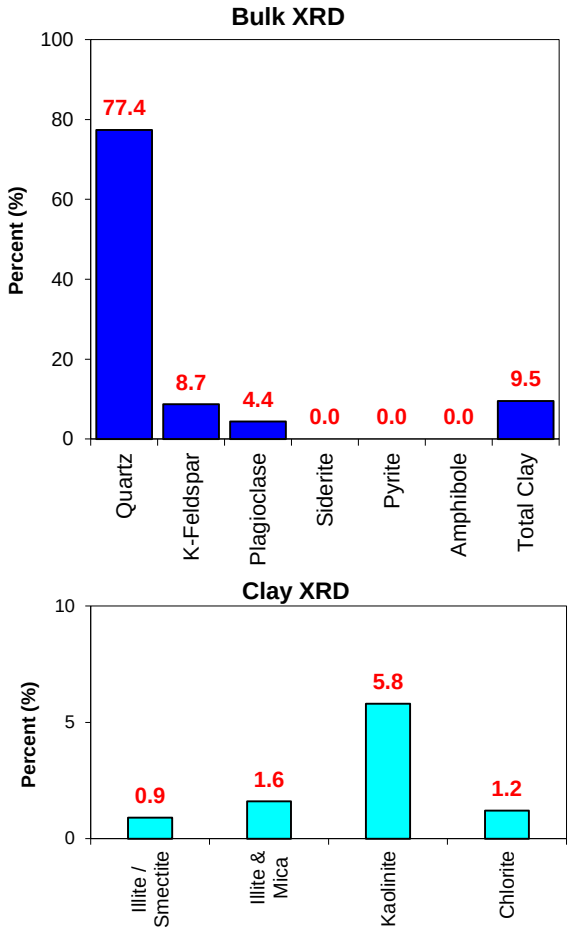
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

SEM images of these coarse grains show that this sample is poorly consolidated and only traces of overgrowth cements are holding the grains together. The clays clinging to the K-feldspar surface are kaolinitic in composition (yellow arrows). Red arrows indicate very thin partial K-feldspar overgrowths on a detrital K-feldspar grain.

Core Lab
RESERVOIR OPTIMIZATION

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

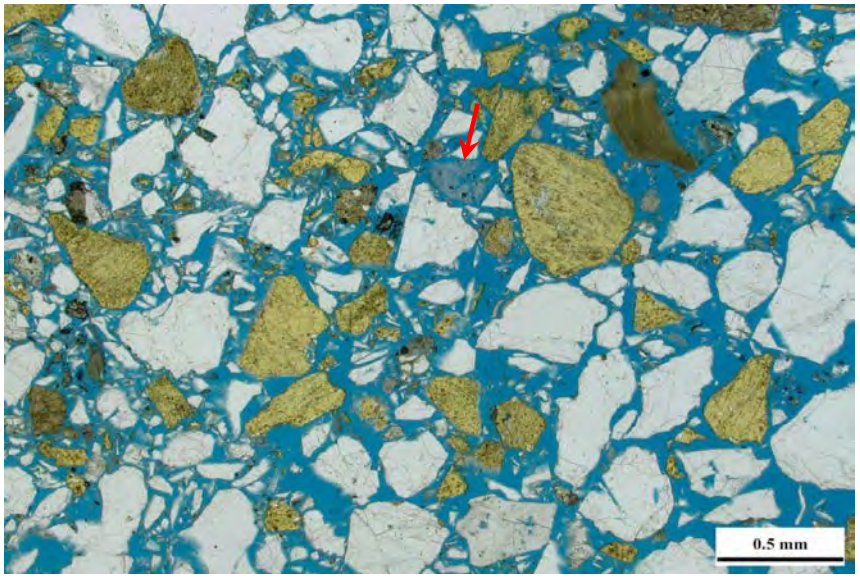
Core Data (nearest adj.):

Porosity (%)*:	36.3
Permeability (md)*:	13197.8
Grain Density (g/cc):	2.63

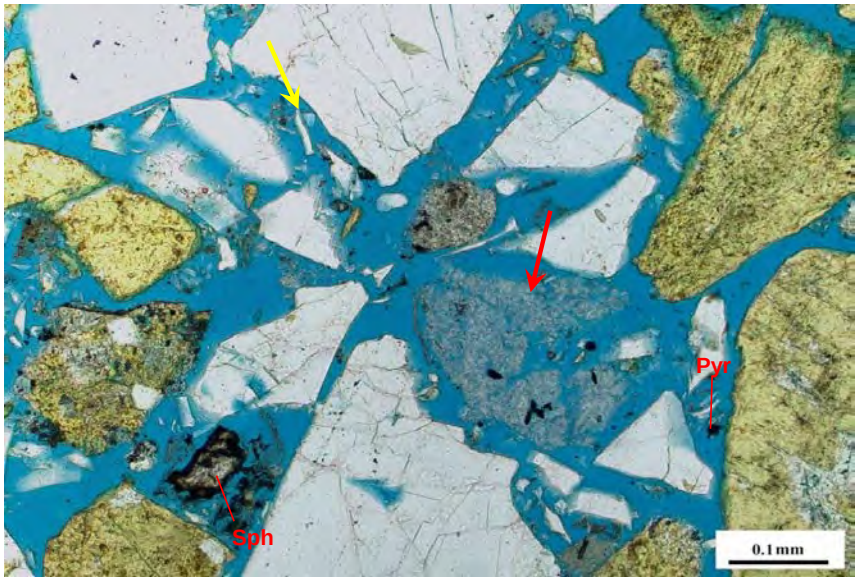
PLATE 9
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4775.50
Sample ID: 129

A PL



B UV



Sample Description

Lithology: sandstone

Classif. (Folk, 1980): subarkose
Grain Size (range): upper medium-lower coarse sand
Sorting: well

Structures:
homogeneous, massive; coring dilation and grain fracturing

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert

Other Grains:
minor biotite and muscovite flakes, trace sphene, amphibole

Matrix:
none observed

Authigenic minerals:
kaolinite grain replacement, trace pyrite

Pore Types:
probable abundant intergranular pores, moderate intragranular pores in feldspar, moderate kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	74.7	Siderite	0.0
K-Feldspar	10.8	Amphibole	0.0
Plagioclase	6.5	Pyrite	0.0
		Total Clay	8.0

Clay Abundance (Weight %)

Illite / Smectite	1.0	Kaolinite	3.6
Illite & Mica	2.2	Chlorite	1.2

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This sample is distinctive in having the lowest clay content by XRD. Much less detrital biotite and muscovite is observed (Photo A). Much of the thin section consists of highly fractured grain fragments (upper left; Photo A) but the less fractured area (lower right; Photo A) shows abundant quartz (white), with common amounts of K-feldspar (stained yellow). Kaolinite occurs rarely as a grain replacement mineral (red arrows). The yellow arrow in Photo B indicates a quartz fracture fragment comparable to Photo C. Trace amounts of sphene (Sph) and authigenic pyrite (Pyr) are present.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	35.6
Permeability (md)*:	19087.1
Grain Density (g/cc):	2.62

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PLATE 9 (cont'd)

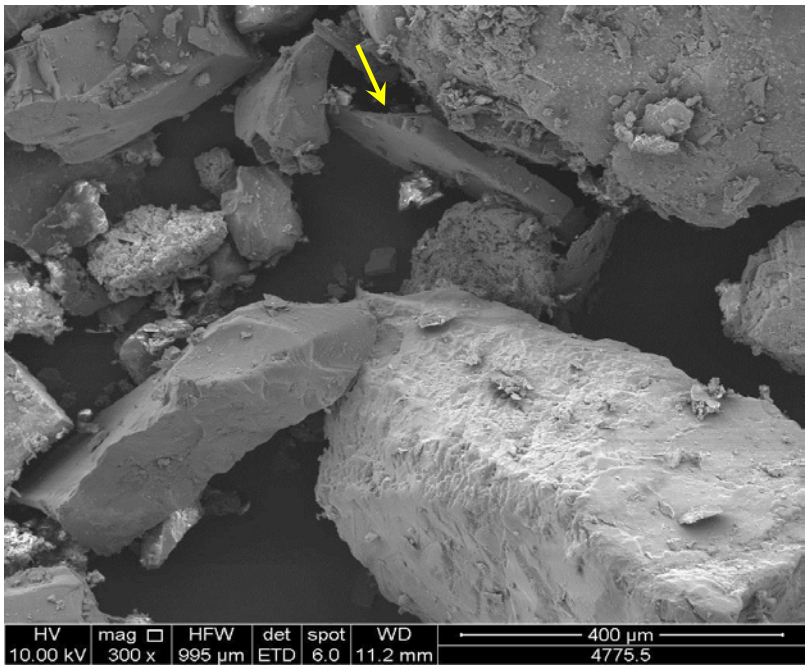
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4775.5
Sample ID: 129

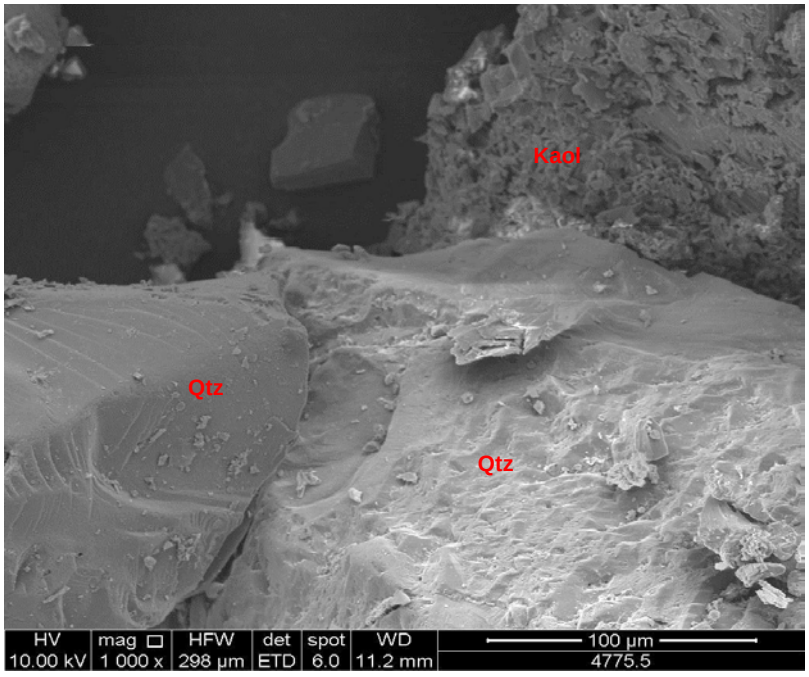
Lithology: sandstone

Classif. (Folk, 1980): subarkose
Grain Size (range): upper medium-lower coarse sand
Sorting: well

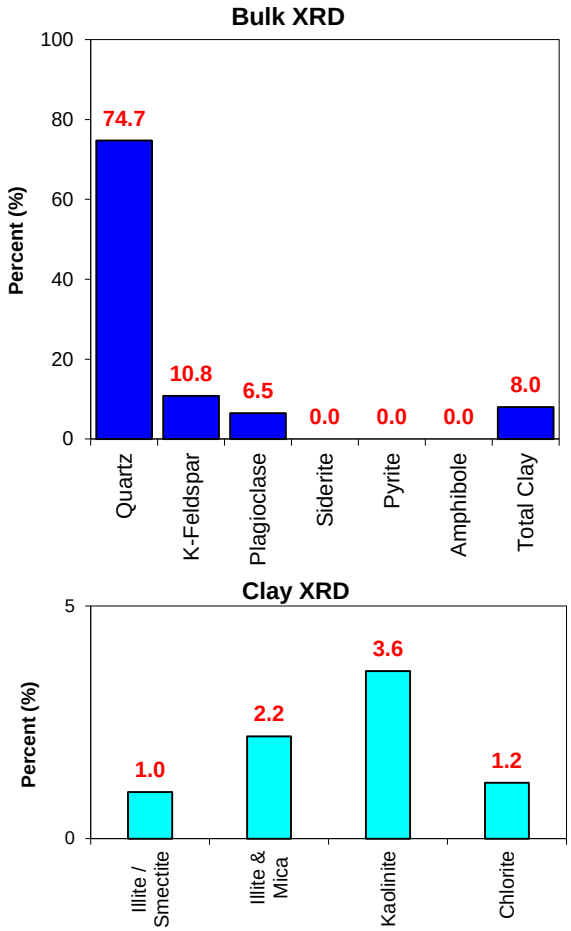
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

SEM images show unconsolidated grains of quartz (Qtz) with kaolinitic clay (Kaol). Yellow arrow indicates a fracture fragment.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

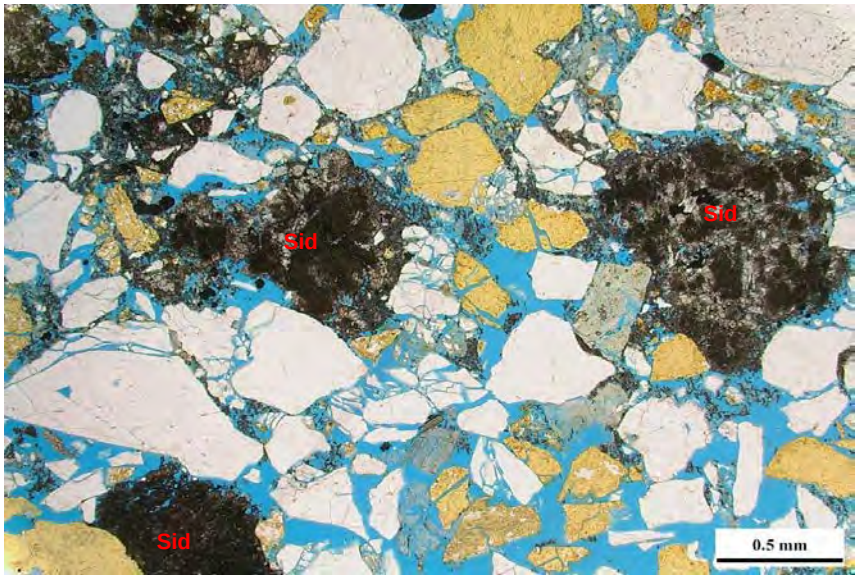
Core Data (nearest adj.):

Porosity (%)*:	35.6
Permeability (md)*:	19087.1
Grain Density (g/cc):	2.62

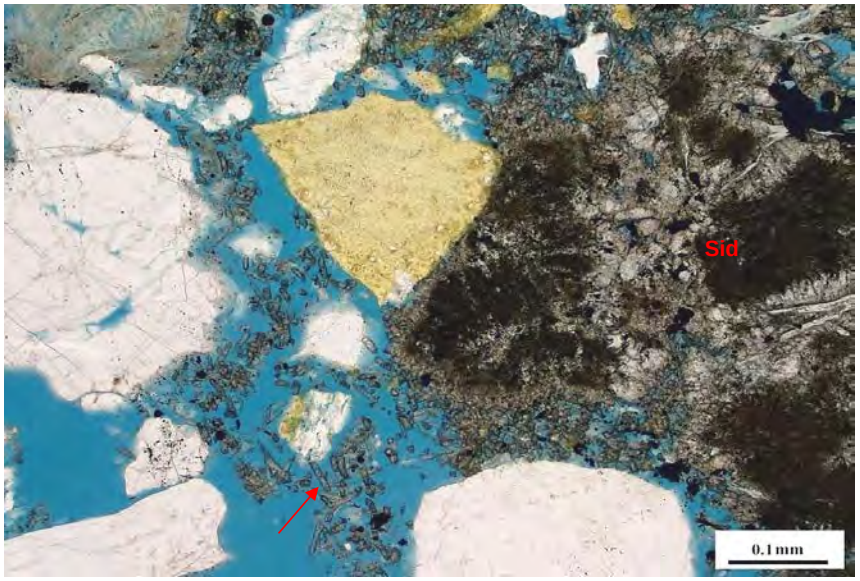
PLATE 10
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4778.50
Sample ID: 132

A PL



B UV



Sample Description

Lithology: sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): coarse sand-granule
Sorting: moderate

Structures:
homogeneous, massive; argillaceous and silty rip-up clasts; sideritic granules; coring dilation

Framework Grains:
abundant quartz, moderate K-feldspar, moderate plagioclase, minor plutonic and metamorphic lithic fragments, rare chert, volcanic rock fragments

Other Grains:
common biotite; minor sideritic granules, moderate plant fragments, trace zircon, epidote

Matrix:
none observed

Authigenic minerals:
moderate siderite microcrystals associated with biotite and as pore-filling cement; kaolinite grain replacement

Pore Types:
minor intergranular pores, minor intragranular pores, kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	54.2	Siderite	13.9
K-Feldspar	10.5	Amphibole	0.0
Plagioclase	3.8	Pyrite	0.8
		Total Clay	16.7

Clay Abundance (Weight %)

Illite / Smectite	4.6	Kaolinite	8.7
Illite & Mica	1.7	Chlorite	1.7

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This sample is distinctive in having the highest siderite content (by XRD) and in containing sideritic granules (Sid), plutonic granules, and siltstone to mudstone rip-up clasts. Large plant fragments are also present. Siderite granules are composite grains that appear to be mudstone clasts replaced and cemented by siderite. Siderite crystals within intergranular pores are prismatic and range up to 80 microns in length (red arrow). Small siderite crystals show significant dislocation by coring and appear to have been more pervasive.

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Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	33.6
Permeability (md)*:	5514.1
Grain Density (g/cc):	2.74

PLATE 10 (cont'd)

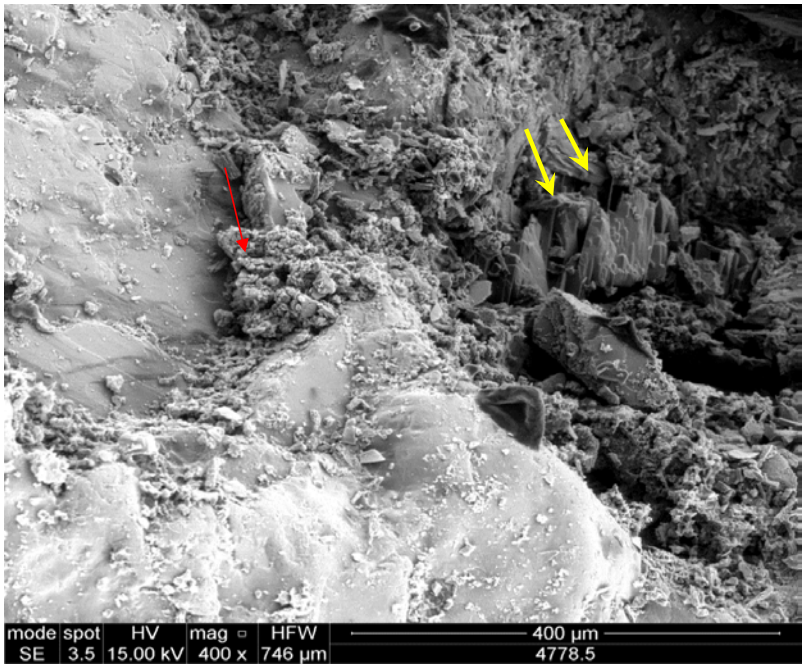
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4778.5
Sample ID: 132

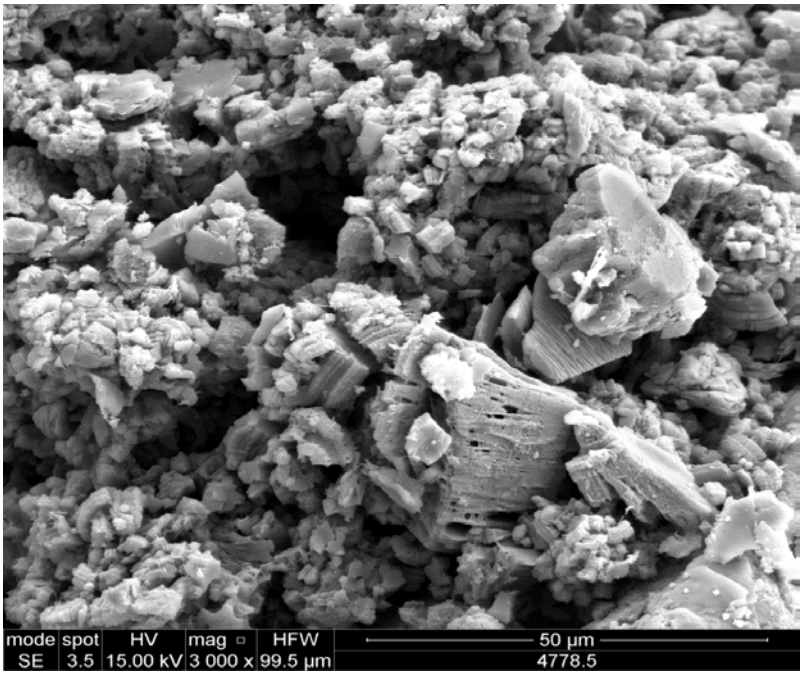
Lithology: sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): coarse sand-granule
Sorting: moderate

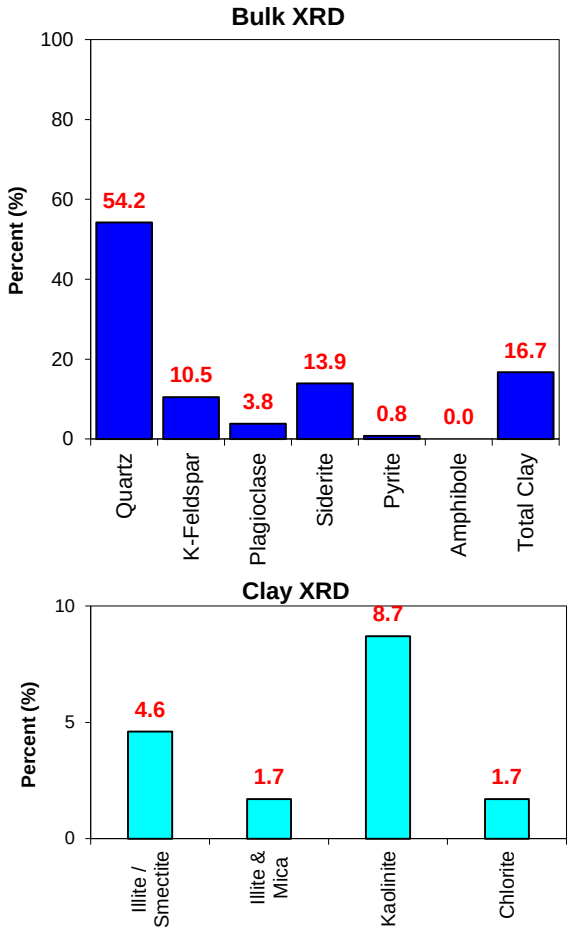
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

The SEM sample for this sandstone consists of loose grains. A quartz grain has a cluster of kaolinite resting on its surface (red arrow). At higher magnification, the kaolinite booklets show a densely packed but highly microporous fabric. One kaolinite booklet is larger than all the others. Yellow arrows in Photo C indicate a plagioclase grains that is partly dissolved. Two sessions on this sample, yet siderite was not found in SEM.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

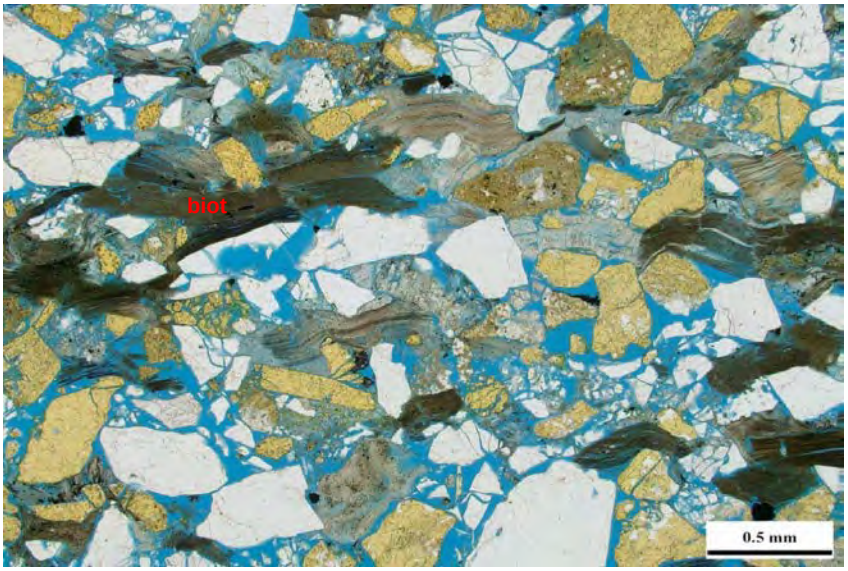
Core Data (nearest adj.):

Porosity (%)*:	33.6
Permeability (md)*:	5514.1
Grain Density (g/cc):	2.74

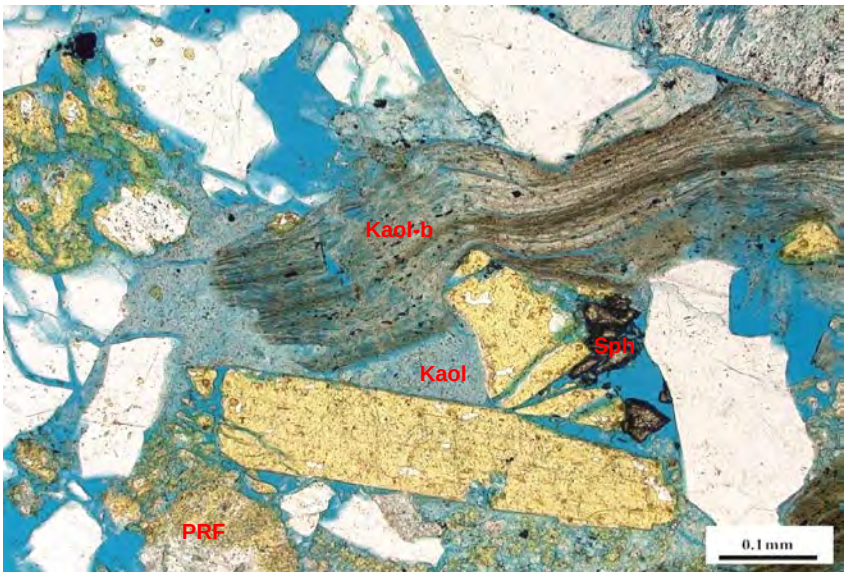
PLATE 11
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4782.50
Sample ID: 136

A PL



B UV



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: moderately well

Structures:
massive, alignment of mica flakes in part of sample; coring dilation evident

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert, volcanic rock fragments

Other Grains:
common biotite, trace sphene

Matrix:
none observed

Authigenic minerals:
kaolinite replacing grains and biotite; minor framboidal pyrite

Pore Types:
abundant intergranular pores, minor intragranular pores in feldspar, common kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	52.9	Siderite	0.0
K-Feldspar	11.9	Amphibole	0.0
Plagioclase	6.5	Pyrite	0.0
		Total Clay	28.6

Clay Abundance (Weight %)

Illite / Smectite	3.9	Kaolinite	18.0
Illite & Mica	5.3	Chlorite	1.4

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows the alignment of biotite (biot) and other mica flakes that defines lamination. White grains are quartz and plagioclase. Unbroken white grains are mostly quartz. Yellow-stained grains are K-feldspar. Grain-sized patches of white fragments are often plagioclase grains that are extensively dissolved. These delicate grains were highly susceptible to dilation during coring, thus the intragranular pores are poorly preserved. Photo B shows a primary pore filled with authigenic kaolinite (Kaol). The pore looks natural as it is bounded by grains that do not look damaged. A biotite flake shows heavy kaolinization (Kaol-b). Other noted grains include a plutonic lithic fragment (PRF) and sphene (Sph). The faint blue color of the two types of kaolinite indicates that it is microporous.

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Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	32.0
Permeability (md)*:	1074.8
Grain Density (g/cc):	2.64

PLATE 11 (cont'd)

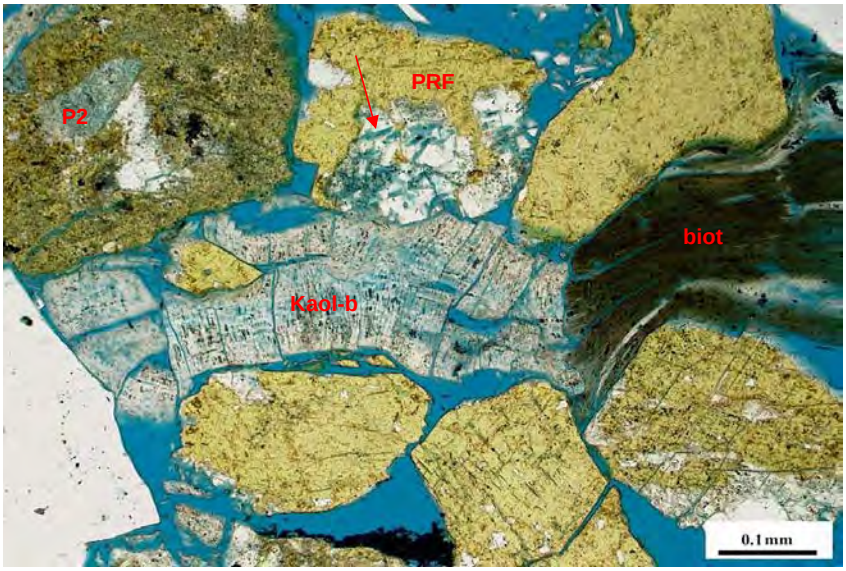
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4782.5
Sample ID: 136

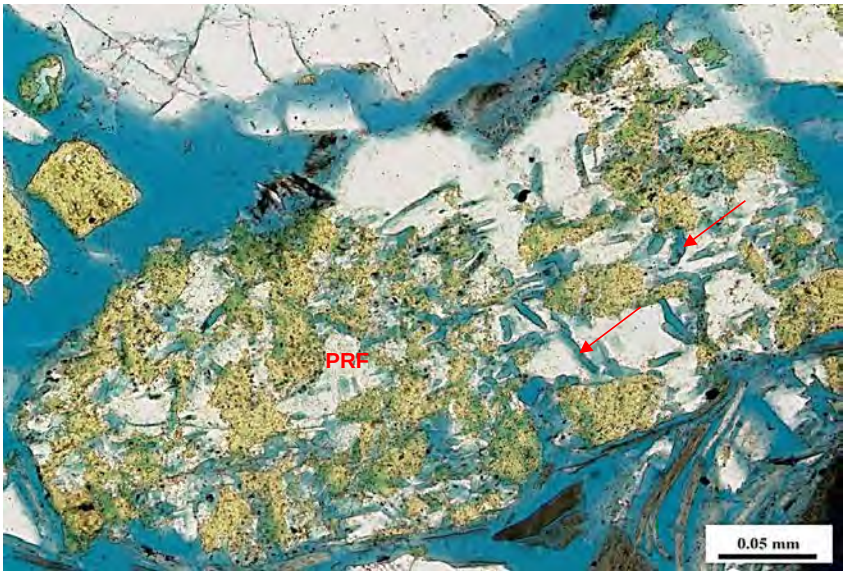
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: moderately well

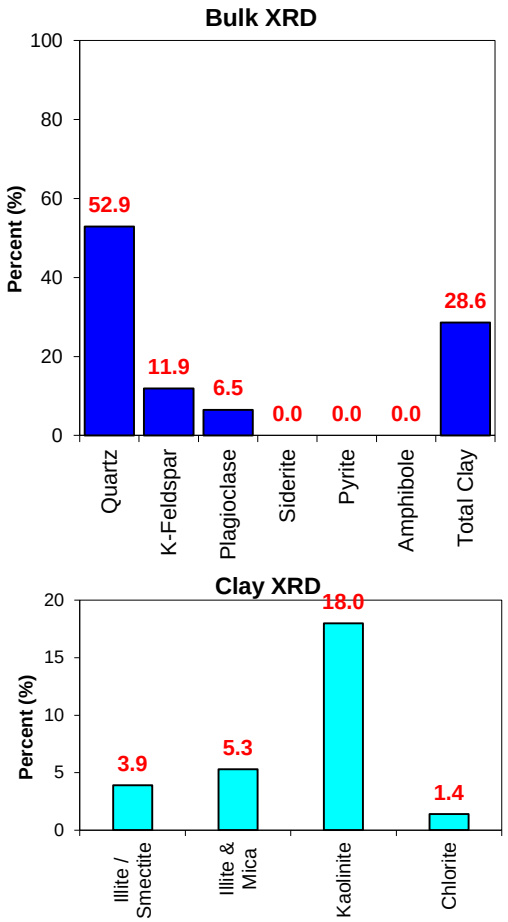
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

These supplemental photomicrographs document the selective intragranular dissolution pores (red arrows) within plagioclase crystals in plutonic lithic fragments (PRF). These wormy dissolution pores lead to greater intragranular grain fracturing during coring, which is why most of the fragmented grains are plagioclase. A heavily kaolinized biotite flake (Kaol-b) and less altered biotite (biot) are also noted. Micropores are present in the kaolinized biotite flake. Intragranular pores (P2) also occur in the lithic fragment in the upper left corner (Photo C).

Relative Abundances:

Trace	<1%
Minor	1-5%
Moderate	5-10%
Common	10-20%
Abundant	>20%

Core Data (nearest adj.):

Porosity (%)*:	32.0
Permeability (md)*:	1074.8
Grain Density (g/cc):	2.64

PLATE 11 (cont'd)

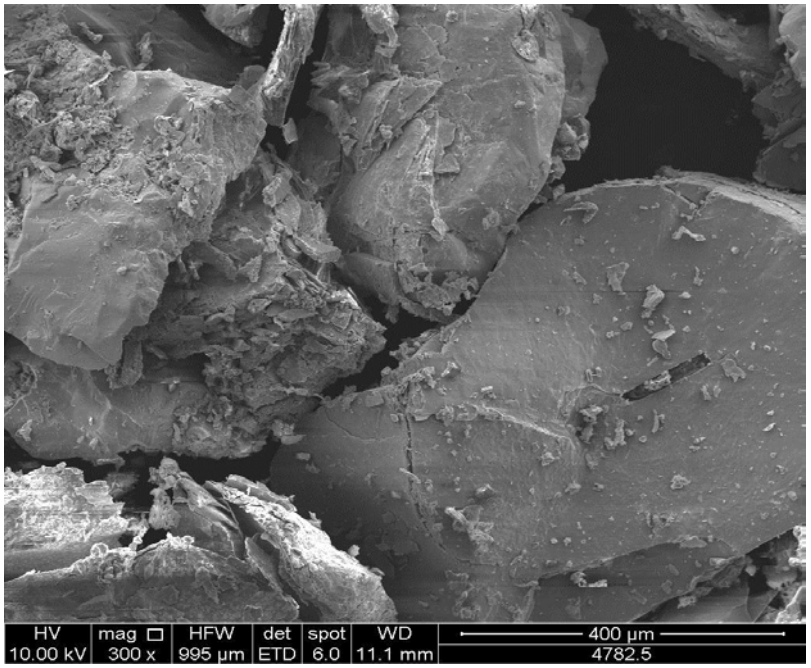
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4782.5
Sample ID: 136

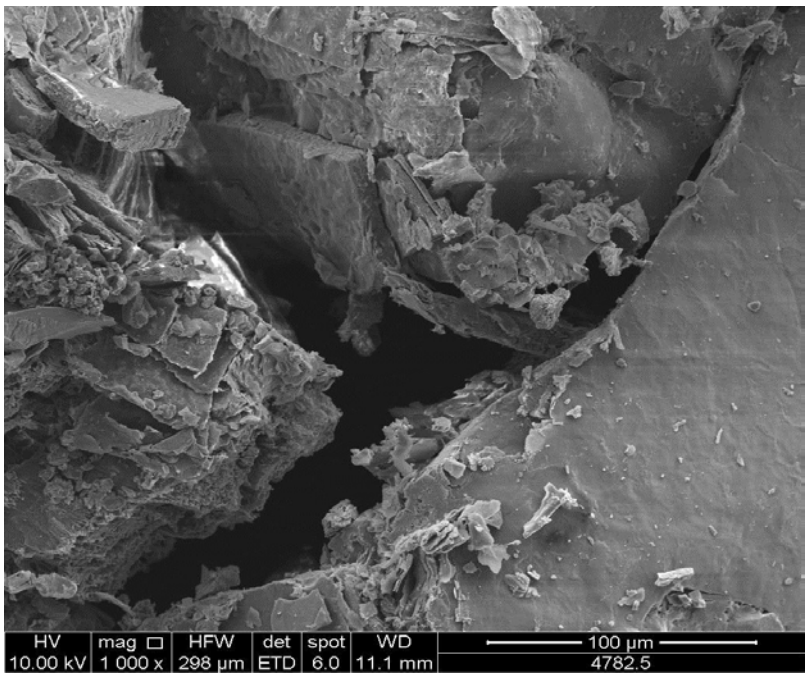
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: moderately well

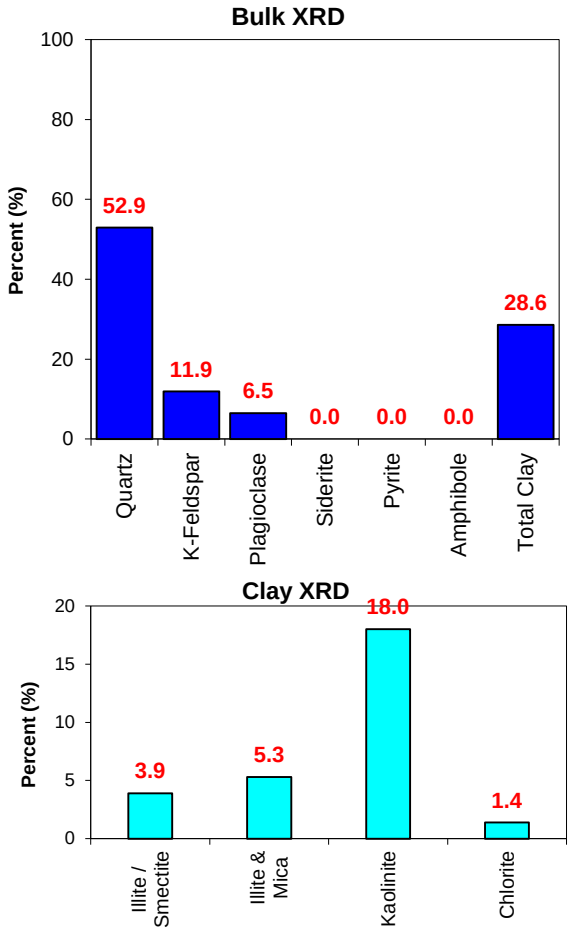
E



F



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

The loose sand grains that make up this SEM sample show no significant siliciclastic overgrowths. Fragments of kaolinite clay cling to some grain surfaces. The intergranular pores are not natural.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

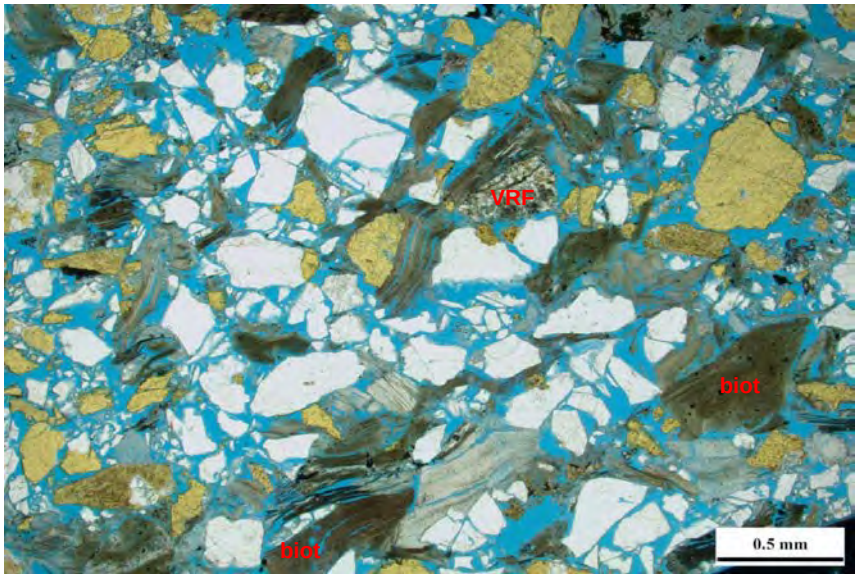
Core Data (nearest adj.):

Porosity (%)*:	32.0
Permeability (md)*:	1074.8
Grain Density (g/cc):	2.64

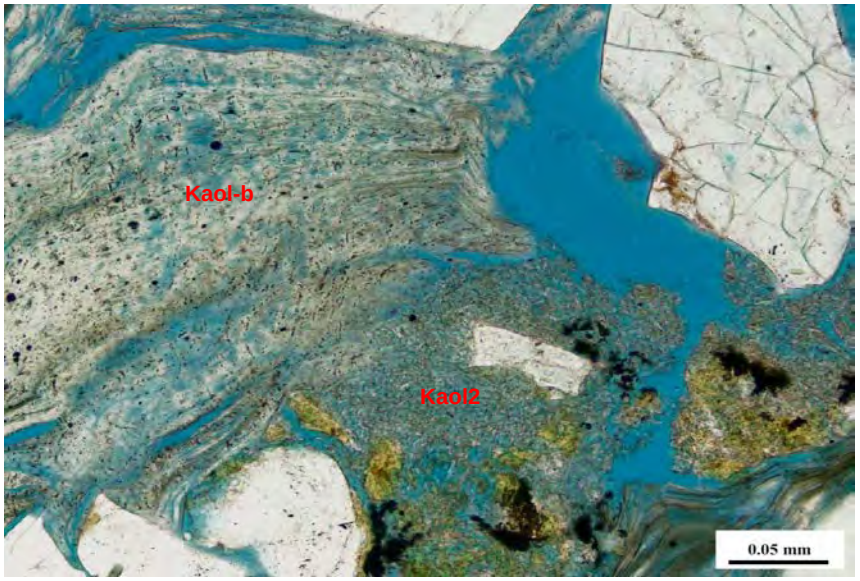
PLATE 12
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4785.50
Sample ID: 139

A PL



B UV



Sample Description

Lithology: **micaceous sandstone**

Classif. (Folk, 1980): arkose
Grain Size (range): upper medium sand
Sorting: moderately well

Structures:
homogeneous, massive; coring dilation and grain fragmentation

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert

Other Grains:
common biotite, trace sphene, epidote, amphibole

Matrix:
none observed

Authigenic minerals:
kaolinite replacing grains and biotite; minor framboidal pyrite

Pore Types:
abundant intergranular pores, minor intragranular pores in feldspar, common kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	53.4	Siderite	0.0
K-Feldspar	14.0	Amphibole	0.0
Plagioclase	7.5	Pyrite	0.0
		Total Clay	25.1

Clay Abundance (Weight %)

Illite / Smectite	2	Kaolinite	16.7
Illite & Mica	4.9	Chlorite	1.5

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Photo A shows that this sample has a massive fabric that exhibits a lot of dilation due to coring. Biotite flakes (biot) show some alignment. The high magnification image shows a biotite flake that is mostly replaced by kaolinite, and is highly microporous (Kaol-b). A plutonic lithic fragment makes up the lower right corner of the image, and more granular kaolinite (Kaol2) has almost completely replaced an area with K-feldspar.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	31.5
Permeability (md)*:	863.6
Grain Density (g/cc):	2.62

Core Lab
RESERVOIR OPTIMIZATION

PLATE 12 (cont'd)

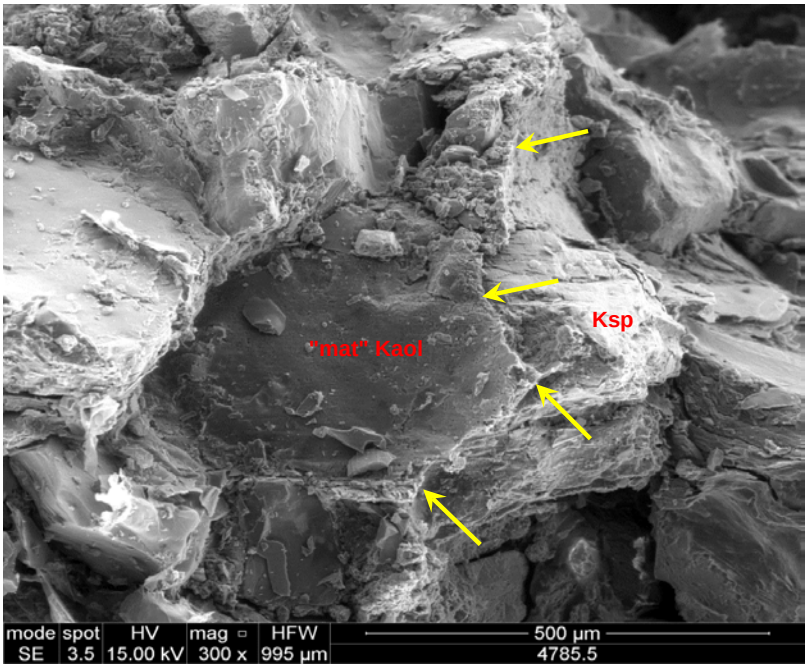
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4785.5
Sample ID: 139

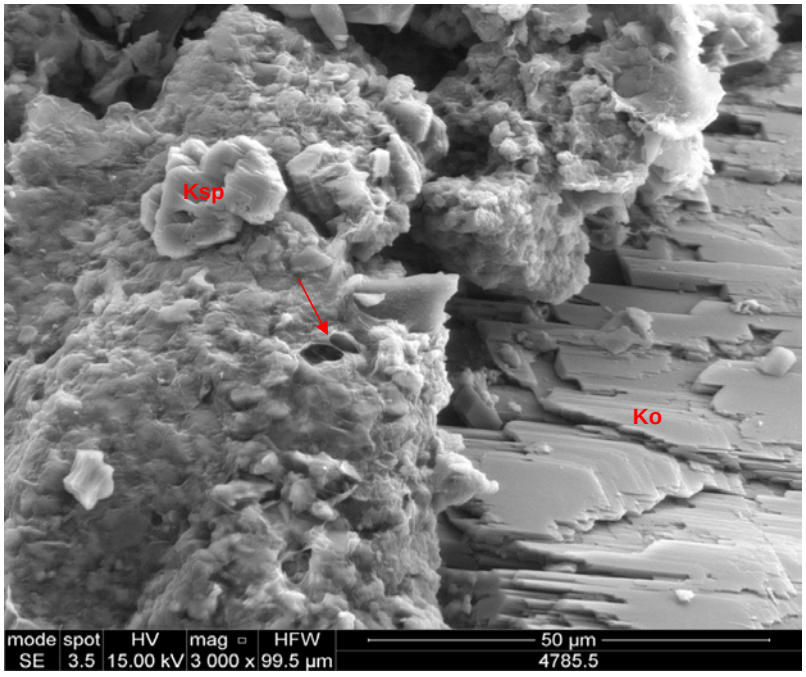
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): upper medium sand
Sorting: moderately well

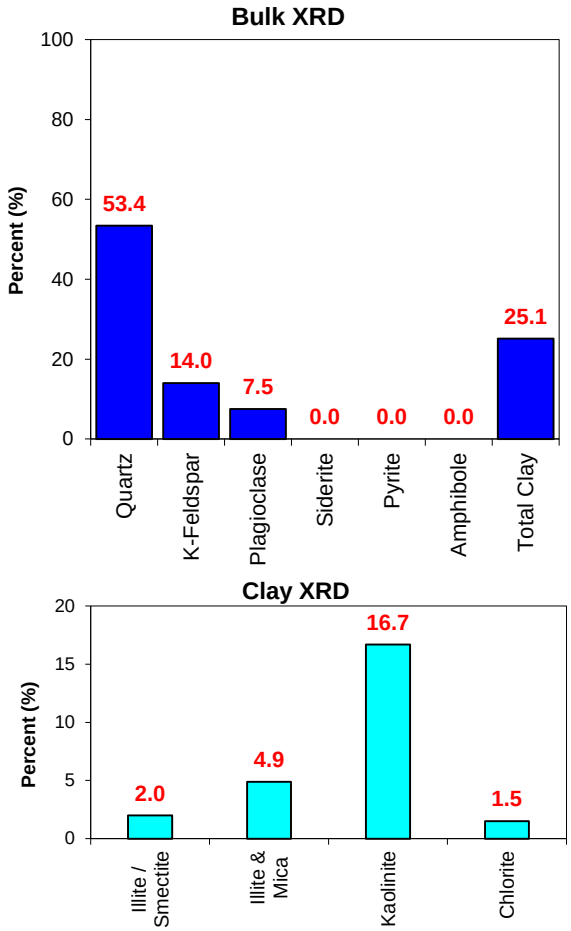
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

This SEM sample contains a rare fragment with grains cemented by a dense mat of kaolinite booklets. Location of plucked grains are marked by the curving surfaces in the cement (yellow arrows). The kaolinite booklets that make up the cement are woven together by mixed-layer illite/smectite clay (Photo D; red arrows). K-feldspar overgrowths are also present (Ko).

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

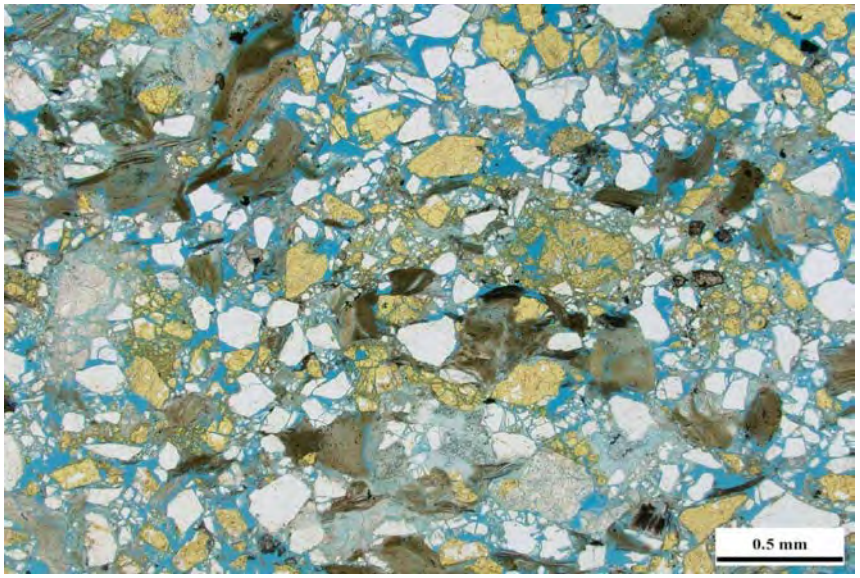
Core Data (nearest adj.):

Porosity (%)*:	31.5
Permeability (md)*:	863.6
Grain Density (g/cc):	2.62

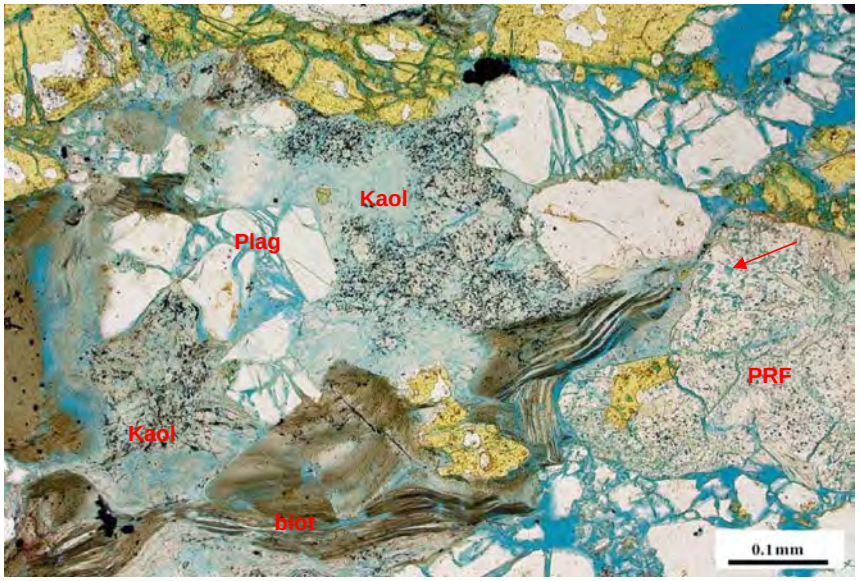
PLATE 13
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4788.50
Sample ID: 142

A PL



B UV



Sample Description

Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): upper fine-lower medium sand
Sorting: moderately well

Structures:
massive, faint alignment of mica flakes; coring dilation and grain fracturing evident

Framework Grains:
abundant quartz, common K-feldspar, minor plagioclase, minor plutonic and metamorphic lithic fragments, rare chert

Other Grains:
common biotite, minor amphibole, trace sphene, epidote

Matrix:
none observed

Authigenic minerals:
moderate kaolinite replacing grains and biotite flakes; minor framboidal and euhedral pyrite

Pore Types:
probable abundant intergranular pores, minor intragranular pores in feldspar, common kaolinite intercrystal micropores

XRD-Whole Rock Mineralogy (Weight %)

Quartz	48.7	Siderite	0.0
K-Feldspar	12.3	Amphibole	2.1
Plagioclase	14.0	Pyrite	0.0
		Total Clay	22.9

Clay Abundance (Weight %)

Illite / Smectite	3.5	Kaolinite	14.7
Illite & Mica	3.0	Chlorite	1.7

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This sample is characterized by a massive fabric that shows extensive coring-induced grain fracturing. Common biotite flakes (biot) show crude alignment. Quartz grains (white) are the most common grain type. Many plagioclase (Plag) grains show dissolution and fracturing, forming grain-sized areas of fracture fragments. K-feldspar is stained yellow. Plagioclase within plutonic lithic fragments (PRF) shows secondary dissolution pores (red arrow). Authigenic minerals include pervasive kaolinite (Kaol) that replaces grains, including biotite.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	35.7
Permeability (md)*:	1133.6
Grain Density (g/cc):	2.65

Core Lab
RESERVOIR OPTIMIZATION

PLATE 13 (cont'd)

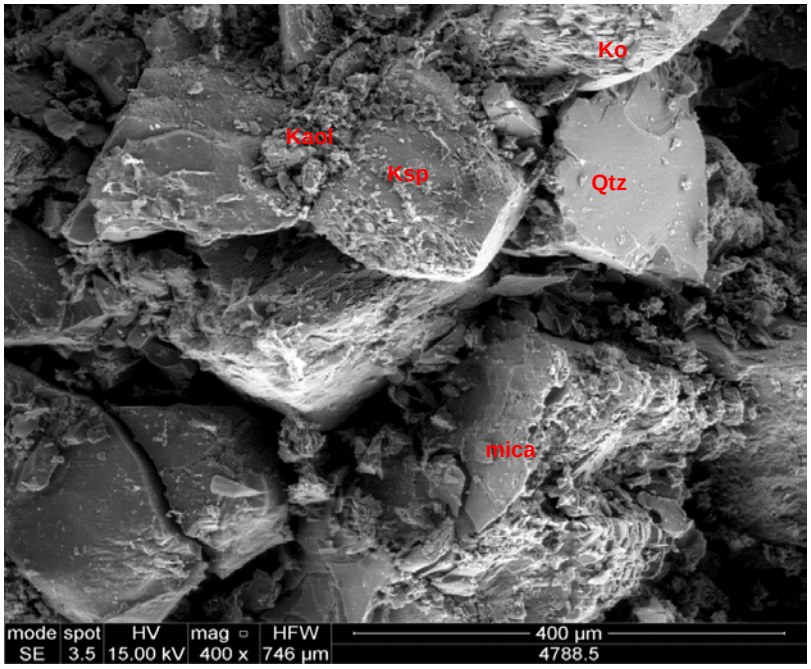
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4788.5
Sample ID: 142

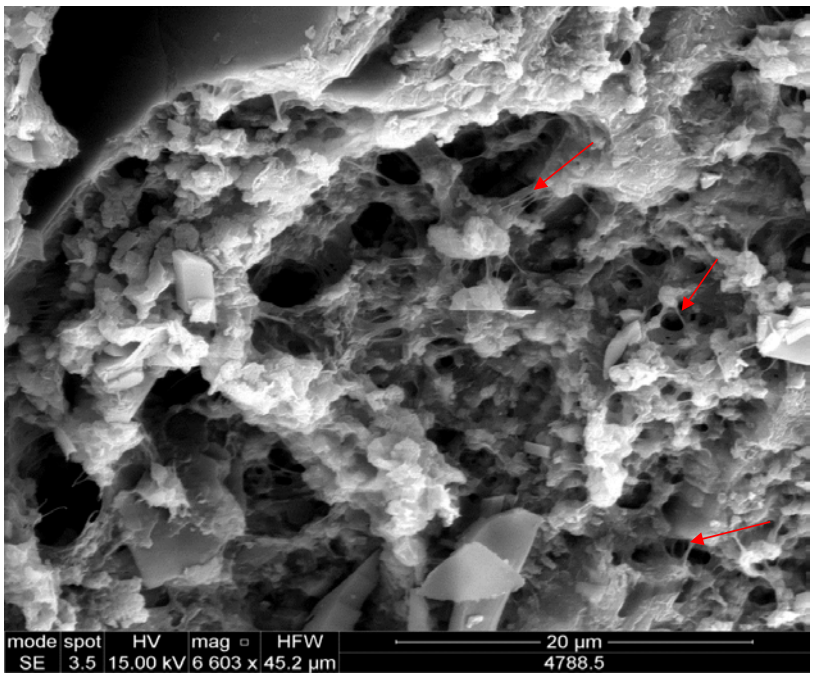
Lithology: micaceous sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): upper fine-lower medium sand
Sorting: moderately well

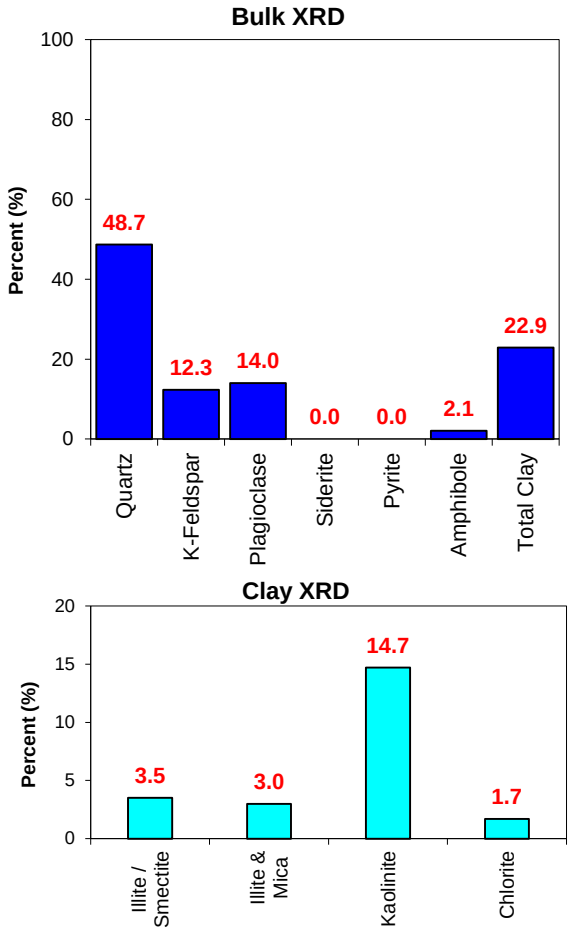
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

Photo C shows quartz (Qtz), feldspar (Ksp), and mica flakes that predominate in this sandstone. Kaolinite occupies intergranular areas. K-feldspar overgrowths (Ko) occur on most K-feldspar grains. Photo D shows the inner microporous structure of the kaolinized mica. Note the microcrystalline kaolinite and webby crystal-bridging mixed-layer illite/smectite clays (arrows).

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

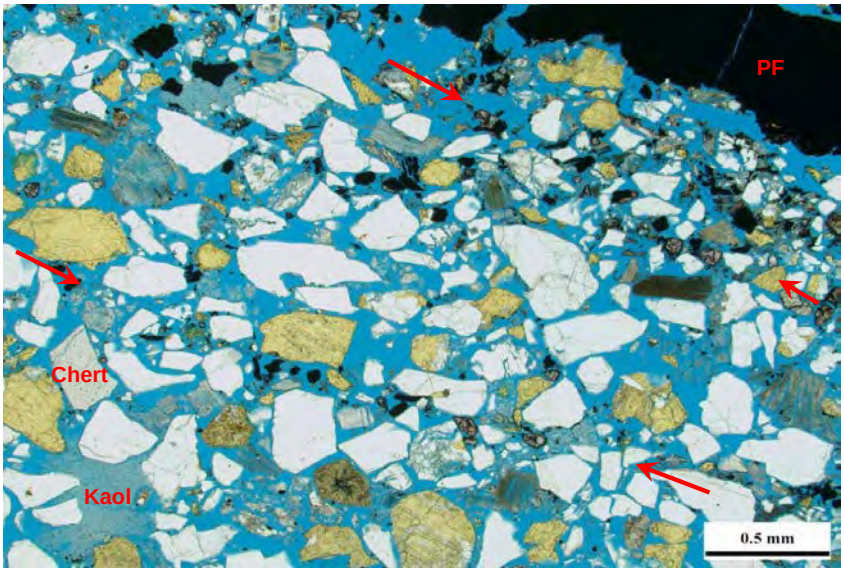
Core Data (nearest adj.):

Porosity (%)*:	35.7
Permeability (md)*:	1133.6
Grain Density (g/cc):	2.65

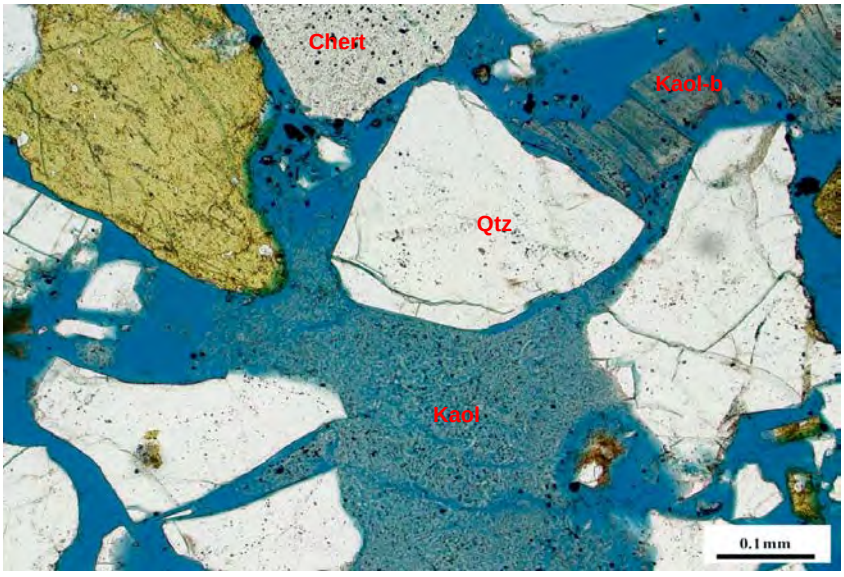
PLATE 14
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4792.20
Sample ID: 145

A PL



B UV



Sample Description

Lithology: sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: well

Structures:
sandstone massive; heavy mineral concentration in a thin lamina adjacent to large plant fragment; coring dilation evident

Framework Grains:
abundant quartz, moderate K-feldspar, moderate plagioclase, minor plutonic and metamorphic lithic fragments, rare chert, volcanic rock fragments

Other Grains:
minor zircon, amphibole, opaque minerals in laminae; common plant fragments up to 2 cm in size

Matrix:
none observed

Authigenic minerals:
moderate intergranular and minor grain-replacing kaolinite, minor pyrite

Pore Types:
abundant intergranular pores, minor intragranular pores, common intercrystal micropores in kaolinite

XRD-Whole Rock Mineralogy (Weight %)

Quartz	66.1	Siderite	0.0
K-Feldspar	9.9	Amphibole	0.0
Plagioclase	9.1	Pyrite	1.1
		Total Clay	13.8

Clay Abundance (Weight %)

Illite / Smectite	2.1	Kaolinite	7.8
Illite & Mica	2.4	Chlorite	1.5

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

This medium-grained sandstone is well sorted, with some fine-grained interlaminae rich in heavy minerals (red arrows) and plant fragments (PF). Monocrystalline quartz (Qtz) is the most abundant framework grain type, although some of the quartz detected in XRD also occurs in chert rock fragments. Kaolinite occurs as densely packed pore-filling masses (Kaol), and replacing biotite (Kaol-b). The blue haze coloration of the kaolinite indicates that it is microporous.

Relative Abundances:

Trace	<1%
Minor	1-5%
Moderate	5-10%
Common	10-20%
Abundant	>20%

Core Data (nearest adj.):

Porosity (%)*:	44.1
Permeability (md)*:	14376.7
Grain Density (g/cc):	2.38

PLATE 14 (cont'd)

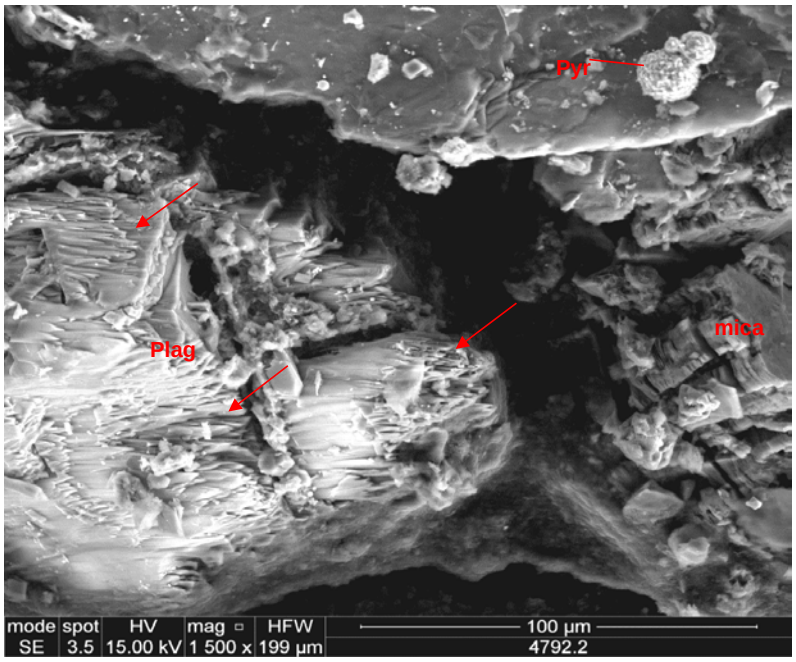
Scanning Electron Microscopy

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4792.2
Sample ID: 145

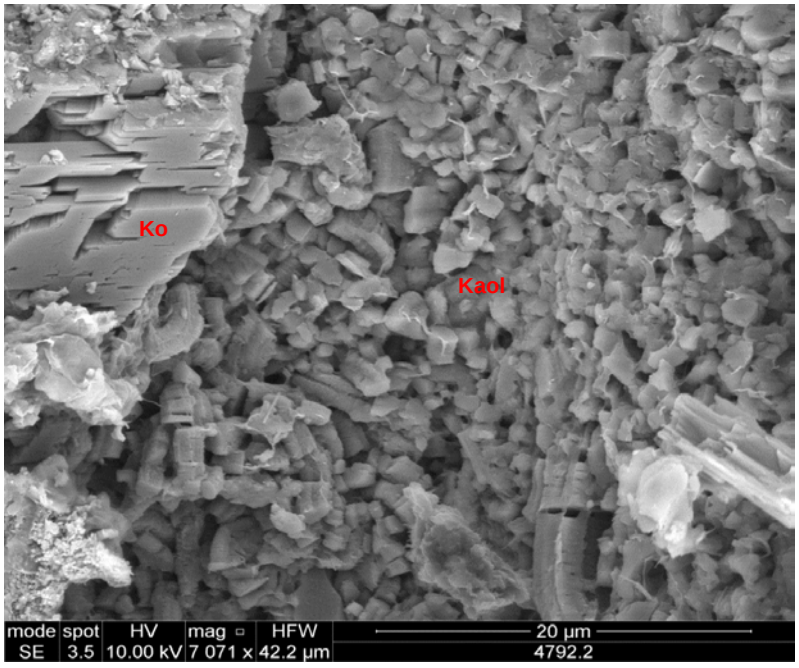
Lithology: sandstone

Classif. (Folk, 1980): arkose
Grain Size (range): medium sand
Sorting: well

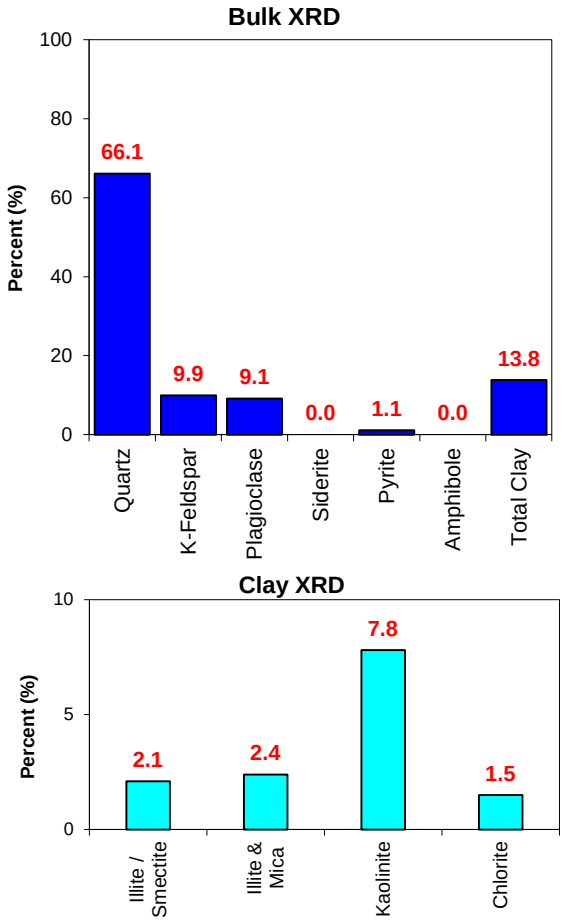
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



**Smectite in mixed-layer illite/smectite is 50-60*

Photomicrograph Caption

The loose grains that make up this SEM sample include quartz, plagioclase (Plag), and mica. EDS analysis of the plagioclase confirms the presence of Si, Al, Na, and Ca. Red arrows indicate dissolution pits in the plagioclase. Elsewhere in the sample (Photo D), a cluster of tightly packed kaolinite (Kaol) that exhibits vermicular booklets was observed. It is probably comparable to cement in Photo B. An adjacent feldspar grain has K-feldspar overgrowths (Ko) with euhedral terminations. The intergranular areas between grains are artificial in Photo C. The intercrystal micropores within the kaolinite are natural. An authigenic pyrite framboid (Pyr) is noted.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

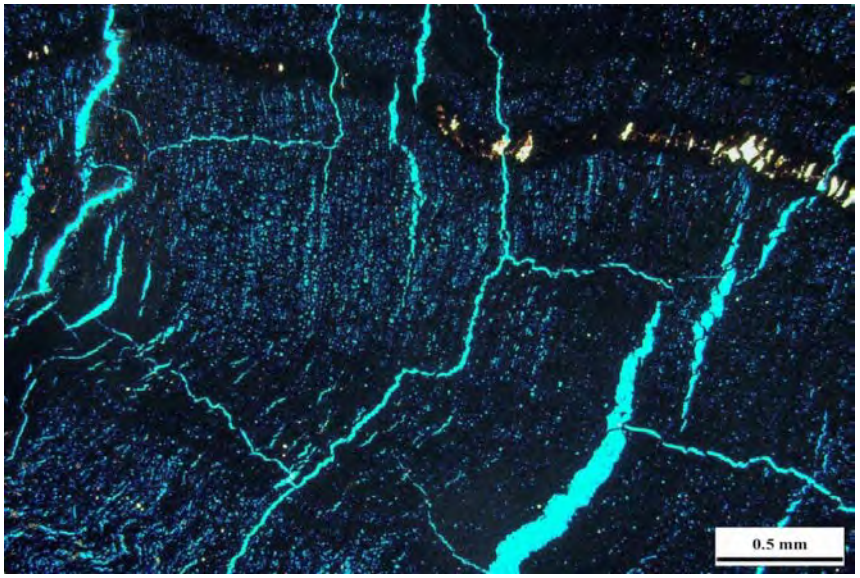
Core Data (nearest adj.):

Porosity (%)*:	44.1
Permeability (md)*:	14376.7
Grain Density (g/cc):	2.38

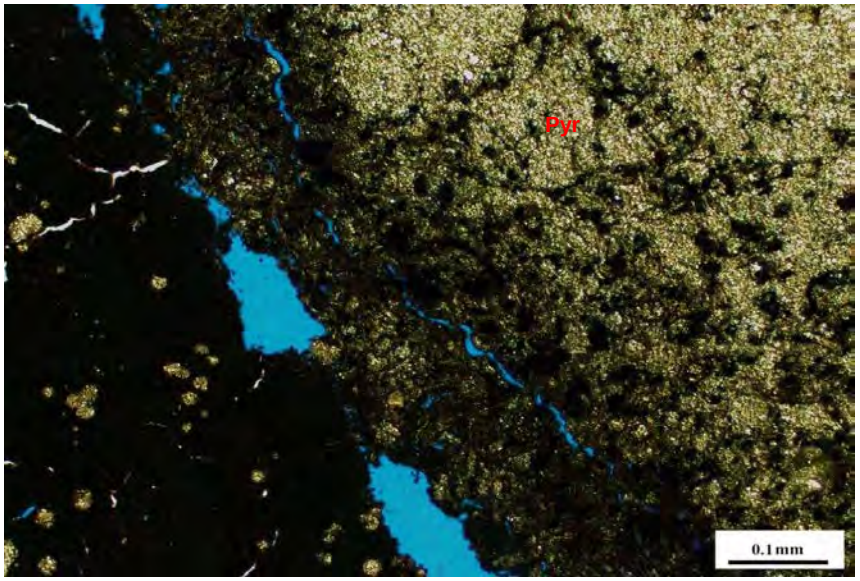
PLATE 15
Thin Section Petrography

Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4796.20
Sample ID: 149

A PL



B RL



Sample Description

Lithology: coal/organic material

Structures:
cellular

Framework Grains:
no grains present

Other Grains:
none observed

Matrix:
none observed

Authigenic minerals:
abundant pyrite replacing plant fragment

Pore Types:
cellular structure within plant fragment

XRD-Whole Rock Mineralogy (Weight %)

Quartz	3.8	Siderite	0.0
K-Feldspar	0.0	Amphibole	0.0
Plagioclase	0.0	Pyrite	96.2
		Total Clay	0.0

Clay Abundance (Weight %)

Illite / Smectite	0.0	Kaolinite	0.0
Illite & Mica	0.0	Chlorite	0.0

%smectite in mixed-layer illite/smectite is 50-60

Photomicrograph Caption

Thin section analysis shows that this sample consists of pyritized plant material. Photo A shows the cellular structure and growth rings in an area that is not replaced by pyrite. Pervasive pyrite (Pyr) replacement in another area of the thin section is shown by the reflected light image (Photo B).

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	55.3
Permeability (md)*:	12667.0
Grain Density (g/cc):	2.04

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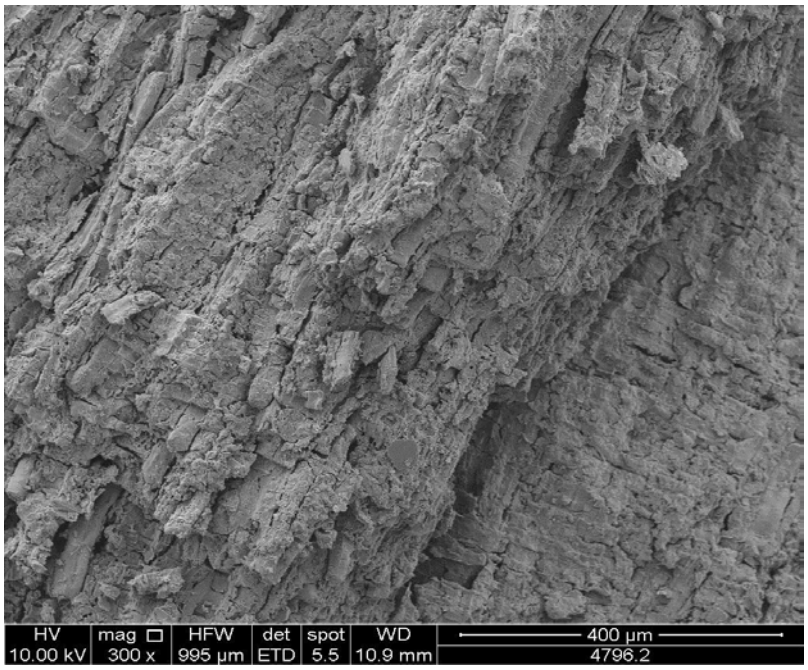
PLATE 15 (cont'd)

Scanning Electron Microscopy

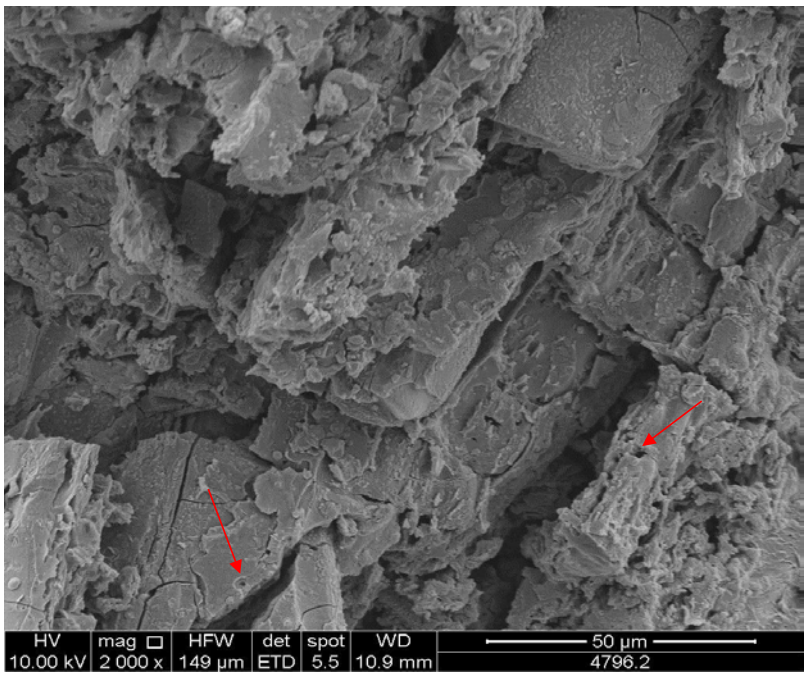
Company: Pacific Gas & Electric Co.
Well: Piacentine 2-27
Location: San Joaquin County, CA
Field King Island
Depth (ft): 4796.2
Sample ID: 149

Lithology: coal/organic material

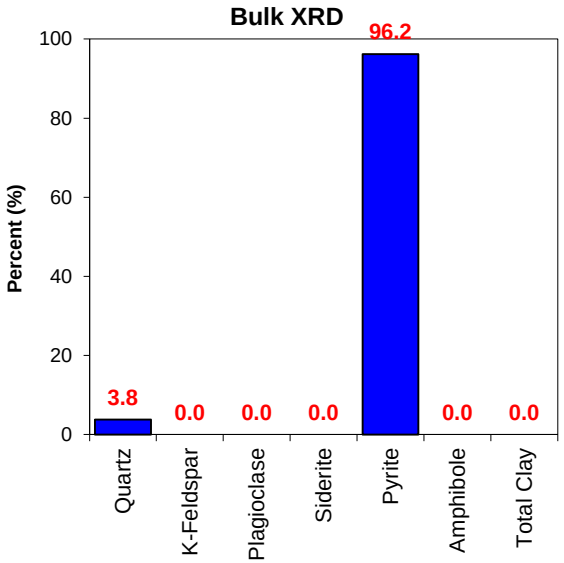
C



D



Mineralogy Determined by X-Ray Diffraction (Wt %)



Photomicrograph Caption

SEM of this plant fragment (coated sample) shows the fibrous cellular structure, with some individual cellular opening indicated in Photo D (red arrows). All locations analyzed using EDS are composed of pyrite.

Relative Abundances:

Trace	**<1%**
Minor	**1-5%**
Moderate	**5-10%**
Common	**10-20%**
Abundant	**>20%**

Core Data (nearest adj.):

Porosity (%)*:	55.3
Permeability (md)*:	12667.0
Grain Density (g/cc):	2.04

SPECIAL CORE ANALYSIS STUDY

Piacentine 2-27 Well
King Island Field
San Joaquin County

Capillary Pressure Final Report

Performed for:

Pacific Gas and Electric Company
6121 Bollinger Canyon Rd, Rm. 2510C
San Ramon, CA 94583

August 2013

File: 57111-313024PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Core Lab
RESERVOIR OPTIMIZATION

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Bakersfield, California 93308
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Fax: 661-325-5808
www.corelab.com

August 29, 2013

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm. 2510C
Ventura, CA 94583

Subject: Advanced Rock Properties Study
File: 57111-313024PG

Dear Mr. Chan:

Enclosed are final Air-Water Capillary Pressure data for six conventional core samples selected by Pacific Gas and Electric Company personnel from Piacentine 2-27 Well, King Island Field, San Joaquin County, California.

This final report contains the test summary, procedures, measured data and CT scans.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. If you have any questions concerning the enclosed information, or if we can be of any additional service, please contact me at 661-325-5657.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

CLB
Listed
NYSE

Client: Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island

CL File No: 313024PG

Summary

Air-Water Capillary Pressure

Pacific Gas and Electric personnel selected six samples from the Piacentine 2-27 core for Capillary Pressure testing. 1.5" inch diameter plugs was drilled at the selected sample locations.

The test brine used was based on a geochemical analysis on produced water from the Piacentine 2-27 well. It was filtered and degassed prior to use. Density was determined at room temperature.

Synthetic Brine Formula

Salt	g/liter
NaCl	11.589
$NaHCO_3$	0.207
KCl	0.063
Na_2SO_4	0.062
$CaCl_2.2H_2O$	1.577
$MgCl_2.6H_2O$	1.087
	14,375ppm

The plug samples were sleeved in nickel with 120 mesh end screens and the sleeve was seated at 300 psi. The samples were CT-scanned to assess suitability for testing. They were cleaned by Soxhlet extraction using a 90:10 methylene chloride and methanol mixture as the solvent and then convection dried at 240°F. When the weight stabilized, dry weight was measured, then grain volume, pore volume and air permeability at 2600 psi net confining stress (NCS requested by PG&E personnel).

The dry samples were vacuum saturated with test brine and then loaded into overburden centrifuge (OBC) cells at 2600 psi NCS.

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

Air-Water Capillary Pressure (cont)

The OBC cells were configured for air displacing water. The sample was centrifugally desaturated of mobile water by gas at eleven speeds equivalent to capillary pressures ranging from 0.25 to 130 psi. The tests were conducted at ambient temperature. The water saturations determined from this test are a function of the displacement pressures used, which can be converted to reservoir pressures and considered analogous to height above free water in the reservoir environment. The pressure range was selected to develop a data curve relating saturation and pressure (height).

To complete the relationship, appropriate conversion values must be input into the following equation:

$$\mathbf{HeightR = PcL * (T\cos\theta R/T\cos\theta L) \div (\rho w - \rho h)}$$

Where:

HeightR	=	Height above free water, initial reservoir conditions
PcL	=	Capillary pressure (laboratory)
$T\cos\theta R$	=	Gas-Water interfacial tension, initial reservoir conditions
$T\cos\theta L$	=	Gas-Water interfacial tension, laboratory
ρw	=	Water density gradient, initial reservoir conditions
ρh	=	Hydrocarbon density gradient, initial reservoir conditions

When correct parameters are used, the calculation converts laboratory capillary pressure to height in the reservoir. Using a fairly typical relationship, a laboratory gas-water capillary pressure of 100 psi would equate to a height of approximately 400 feet in an oil reservoir. This value can be varied substantially by changing input parameters.

The final water saturations ranged from 8.2 to 39.4%. Two samples (depths 4768.1 and 4774.8) exhibited possible bi-modal porosity at the two lowest capillary pressures (0.25 & 0.5 psi).

Client: Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island

CL File No: 313024PG

Test Procedures

Fluid Preparation

- Synthetic brine formula (14,375 ppm) was determined using geochemical analysis of produced water from Piacentine 2-27 Well (CL report: 57111-513082PE).
- Formulate synthetic brine using reagent grade chemicals and deionized water evacuated of air and filtered to 0.2 microns.
- Determine density of the brine at ambient temperature by pycnometer (1.0066 g/cc at 25°C).

Sample Preparation

- Obtain 1.5 inch diameter plug sample at specified location from conventional core using cold nitrogen as the bit coolant.
- Sleeve the samples using nickel and 120 mesh end screens.
- Seat sleeve at 300 psi stress.
- CT-scan plug to access suitability for testing.
- Clean samples by Soxhlet extraction using methylene chloride and methanol mixture, and then convection dry at 240°F until weight is stable.
- Measure dry weight, grain volume, pore volume, and air permeability at 2600 psi NCS.
- Calculate grain density, porosity and air permeability.
- After reviewing basic properties, prepare samples for overburden centrifuge testing.

Gas-Water Capillary Pressure by Overburden Centrifuge Procedure

- Configure Overburden Centrifuge (OBC) cell for air displacing water.
- For higher permeability samples, start at the lowest practical centrifuge speed.
- Monitor time, speed, temperature and volume of water produced.
- Desaturate the samples in a step-wise manner, holding at the same speed until water production has stabilized with a minimum of one day per speed and a total of 8-10 speeds.
- Stability was defined by water production in eight hours of less than 0.001 pore volumes per hour.
- Unload samples at the conclusion of capillary pressure measurements
- Measure weight out of samples and perform Dean-Stark extraction to verify final water saturation.
- Leach salts from the samples using a methanol Soxhlet
- Convection dry to a constant weight at 240°F and measure final dry weight.
- Determine capillary pressure-average water saturation relationships from the rotational speeds and expelled volumes.
- Determine inlet-face water saturations by using the Forbes method.

CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

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Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island
File: 57111-313024PG

Displaced Phase: Water
Displacing Phase: Air
Confining Stress, psi: 2600
Temperature, ° F: Ambient
Saturant: 14K ppm Synthetic Brine

Capillary Pressure, psi:	0	0.25	0.5	1	2	4	8	15	30	60	90	125

Sample Number	Depth, feet	Permeability to Air* md	Porosity* fraction	Initial Water Sat. fraction	Inlet-Face Water Saturation, fraction pore volume									
6	4724.4	86.9	0.270	1.000	1.000	1.000	0.983	0.956	0.874	0.735	0.608	0.513	0.445	0.419	0.394
7	4757.3	3418	0.332	1.000	1.000	0.887	0.565	0.425	0.345	0.274	0.219	0.178	0.148	0.129	0.114
8	4768.1	2790	0.311	1.000	0.767	0.735	0.543	0.385	0.294	0.218	0.168	0.137	0.118	0.107	0.101
9	4774.8	3574	0.315	1.000	0.730	0.715	0.582	0.368	0.254	0.186	0.152	0.127	0.103	0.090	0.082
10	4781.2	2119	0.317	1.000	1.000	0.998	0.723	0.502	0.396	0.304	0.237	0.204	0.174	0.160	0.153
11	4784.3	1733	0.314	1.000	1.000	0.960	0.695	0.494	0.373	0.273	0.213	0.171	0.145	0.137	0.131

* Permeability & Porosity measured at 2600 psi NCS before Pc test.

CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

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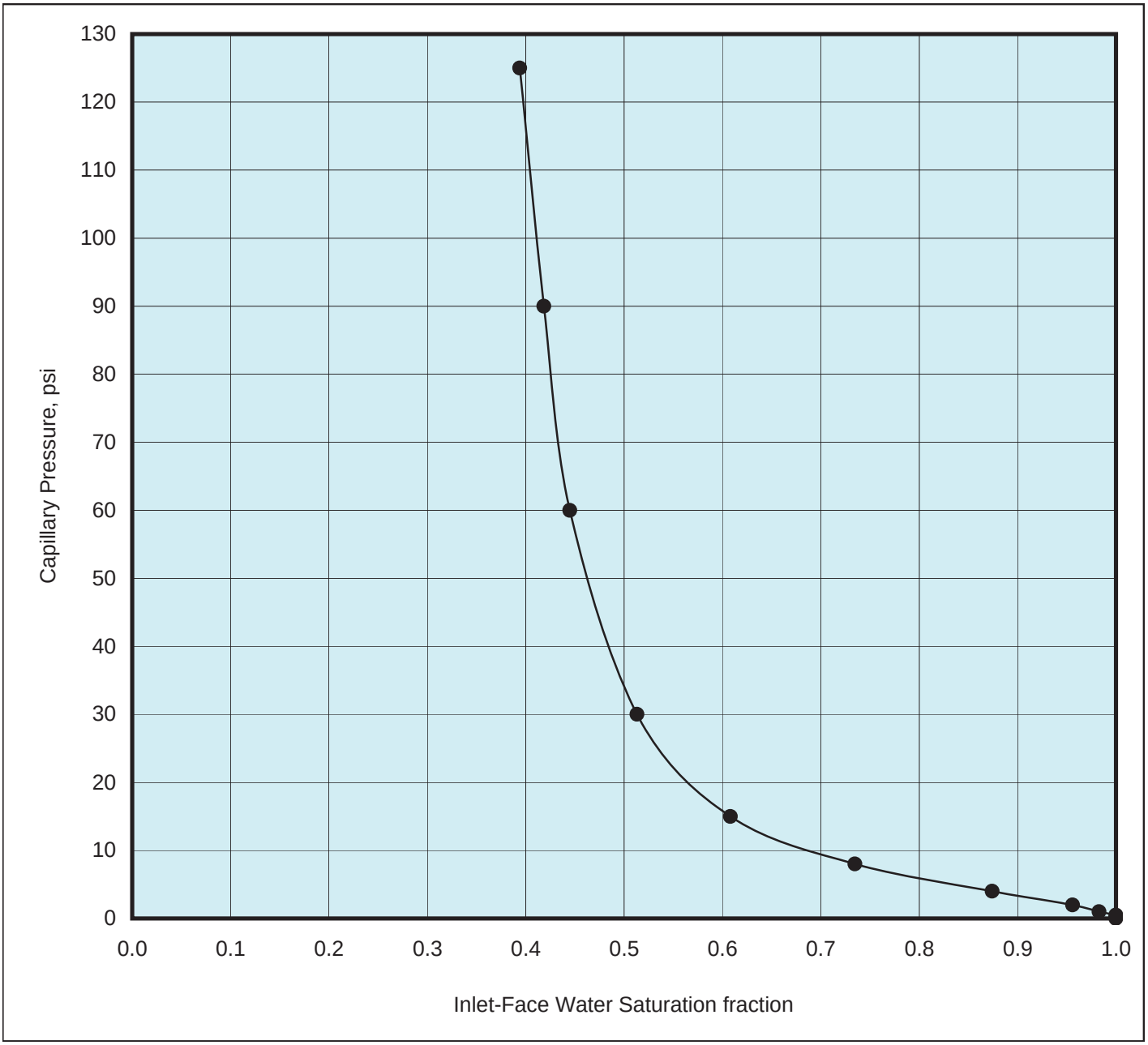
Pacific Gas and Electric Company

Well:	Piacentine 2-27
Field:	King Island
File:	57111-313024PG

Sample Number:	6
Depth, feet:	4724.4
Air Permeability, md:	86.9
Porosity, fraction:	0.270
Initial Saturation, fraction:	1.00
Saturant:	14K ppm Synthetic Brine



CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

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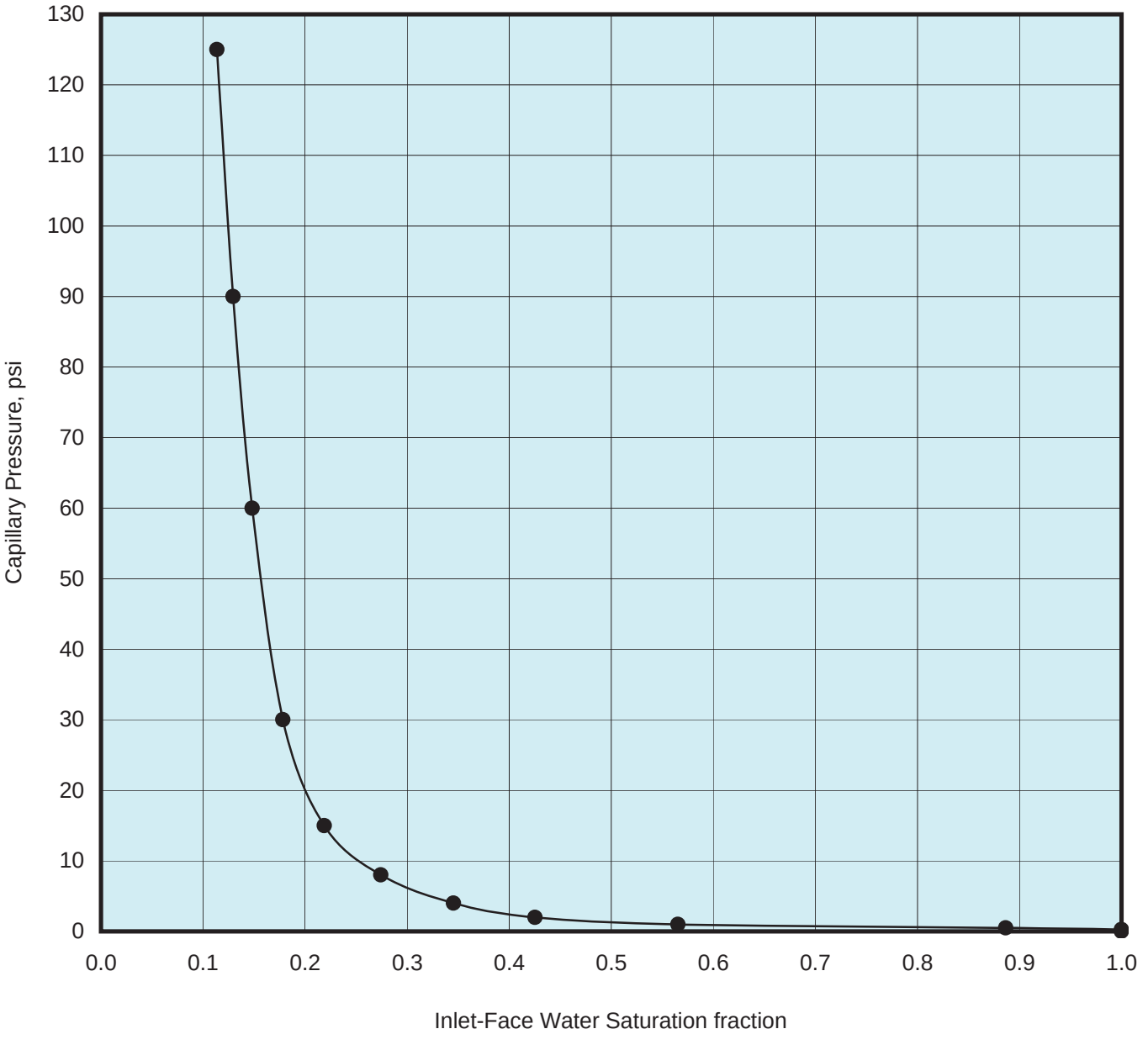
Pacific Gas and Electric Company

Well:	Piacentine 2-27
Field:	King Island
File:	57111-313024PG

Sample Number:	7
Depth, feet:	4757.3
Air Permeability, md:	3418
Porosity, fraction:	0.332
Initial Saturation, fraction:	1.00
Saturant:	14K ppm Synthetic Brine



CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

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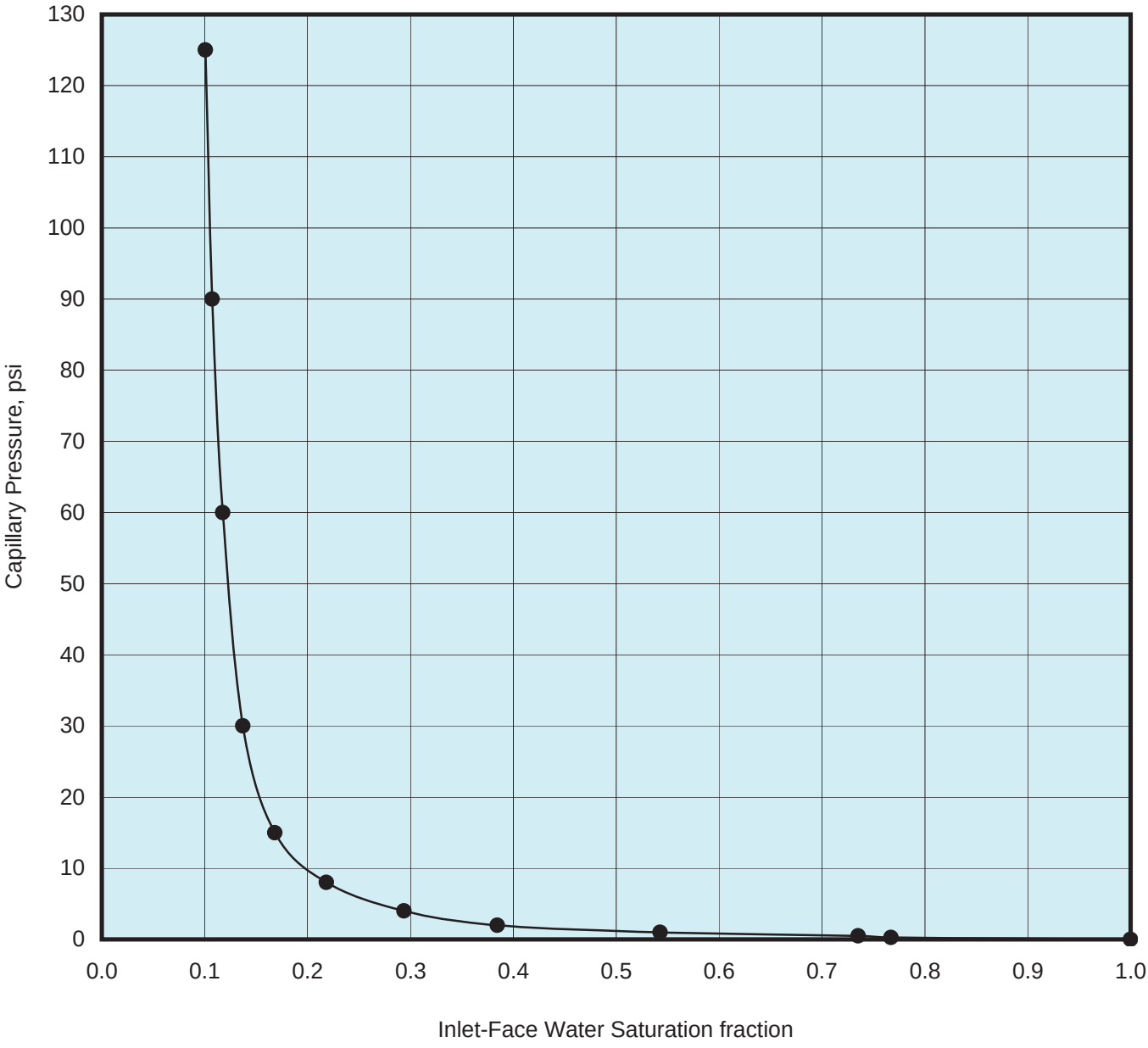
Pacific Gas and Electric Company

Well:	Piacentine 2-27
Field:	King Island
File:	57111-313024PG

Sample Number:	8
Depth, feet:	4768.1
Air Permeability, md:	2790
Porosity, fraction:	0.311
Initial Saturation, fraction:	1.00
Saturant:	14K ppm Synthetic Brine



CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

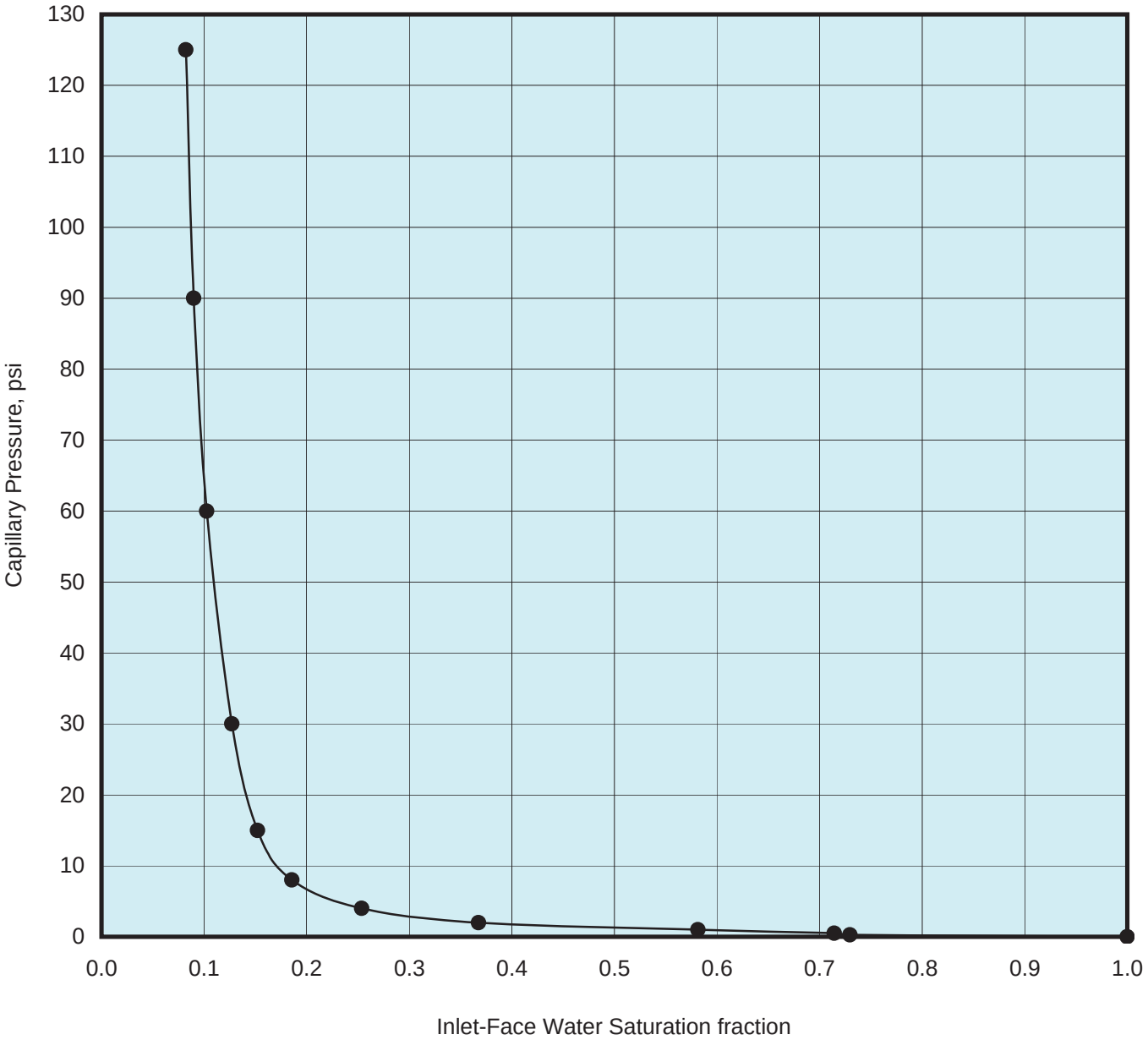
Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Pacific Gas and Electric Company

Well:	Piacentine 2-27
Field:	King Island
File:	57111-313024PG

Sample Number:	9
Depth, feet:	4774.8
Air Permeability, md:	3574
Porosity, fraction:	0.315
Initial Saturation, fraction:	1.00
Saturant:	14K ppm Synthetic Brine



CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

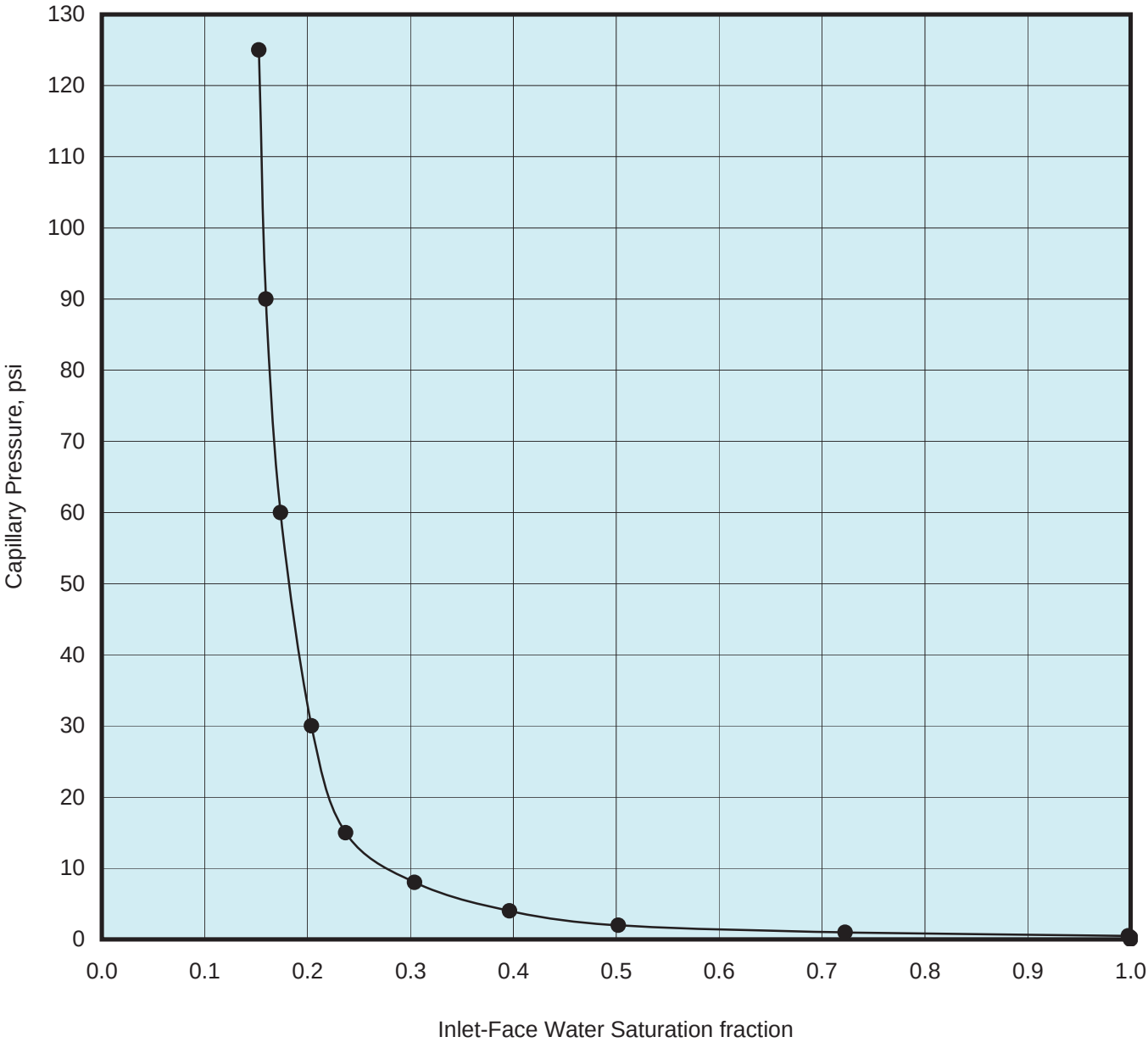
Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Pacific Gas and Electric Company

Well:	Piacentine 2-27
Field:	King Island
File:	57111-313024PG

Sample Number:	10
Depth, feet:	4781.2
Air Permeability, md:	2119
Porosity, fraction:	0.317
Initial Saturation, fraction:	1.00
Saturant:	14K ppm Synthetic Brine



CAPILLARY PRESSURE

Overburden Centrifuge Method
Air-Water System

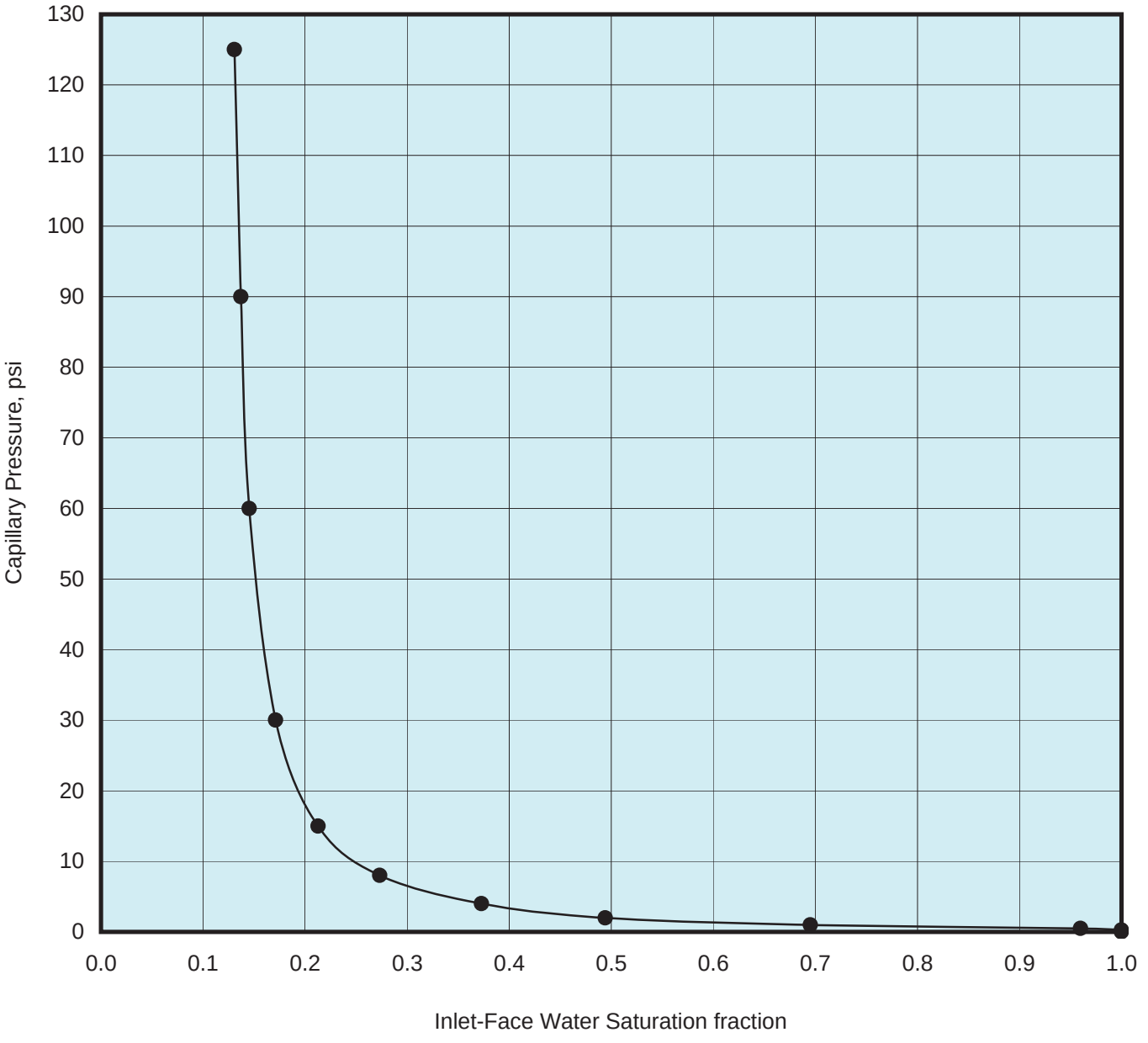
Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Pacific Gas and Electric Company

Well:	Piacentine 2-27
Field:	King Island
File:	57111-313024PG

Sample Number:	11
Depth, feet:	4784.3
Air Permeability, md:	1733
Porosity, fraction:	0.314
Initial Saturation, fraction:	1.00
Saturant:	14K ppm Synthetic Brine



Basic Properties Summary

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Pacific Gas and Electric Company

File: 57111-313024PG

Well: Piacentine 2-27

Field: King Island

Sample Number	Depth ft	Textural Description from Routine data	Net Confining Stress psi	Grain Volume cc	Pore Volume cc	Porosity fraction	Grain Density g/cc	Permeability to Air md
6	4724.4	Sd gy vf-fgr slty smica	2600	39.87	14.77	0.270	2.65	86.9
7	4757.3	Sd gy vf-mgr sslty mica	2600	32.21	16.01	0.332	2.65	3418
8	4768.1	Sd gy vf-mgr sslty mica lam	2600	34.25	15.43	0.311	2.63	2790
9	4774.8	Sd gy vf-mgr sslty smica	2600	33.31	15.29	0.315	2.63	3574
10	4781.2	Sd gy vf-fgr sslty smica	2600	33.84	15.71	0.317	2.64	2119
11	4784.3	Sd gy vf-mgr sslty mica	2600	34.18	15.65	0.314	2.64	1733

Pacific Gas & Electric Company
Well: Piacentine 2-27
Field: King Island, San Joaquin Co., CA

CL File No.: 313024PG

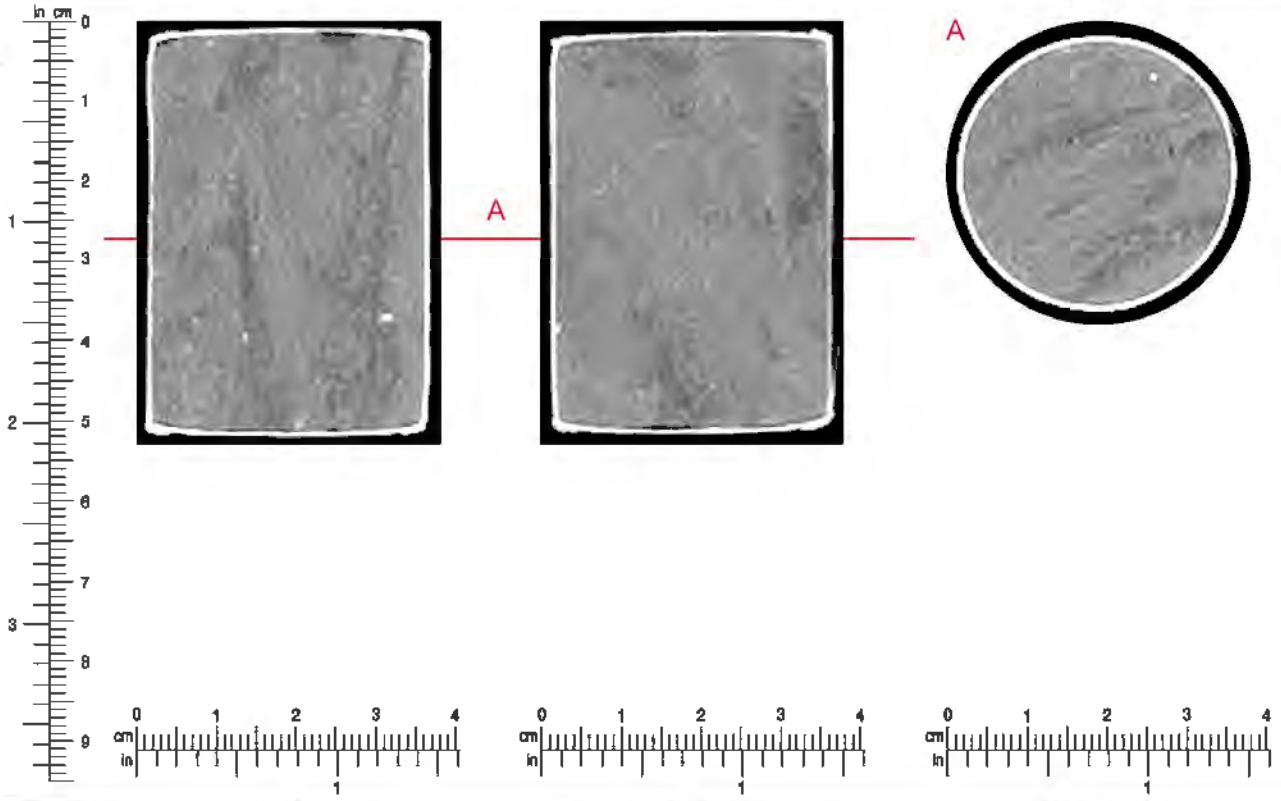
Plug Sample CT Scan

0° 90° Axials

Sample#: 6

Depth (ft):

4724.40

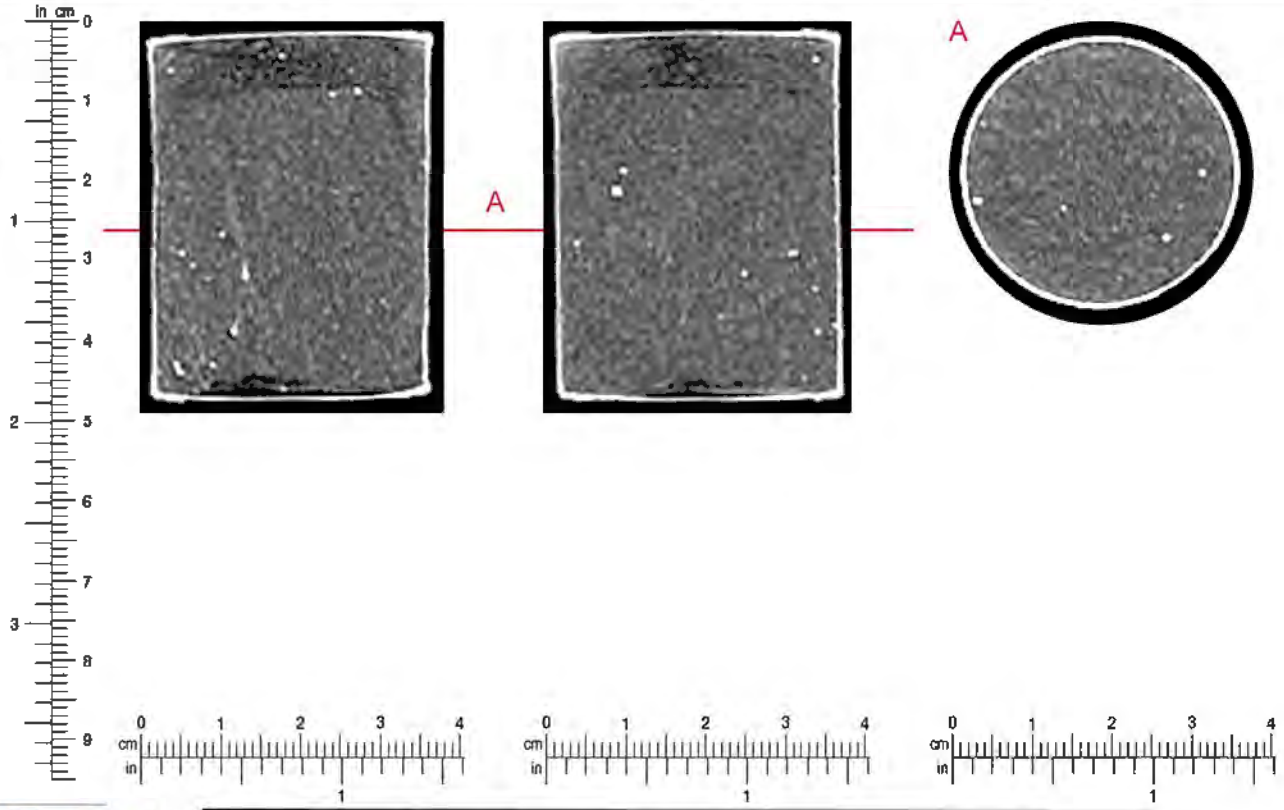


0° 90° Axials

Sample#: 7

Depth (ft):

4757.30



UltraScan

Pacific Gas & Electric Company
Well: Piacentine 2-27
Field: King Island, San Joaquin Co., CA

CL File No.: 313024PG

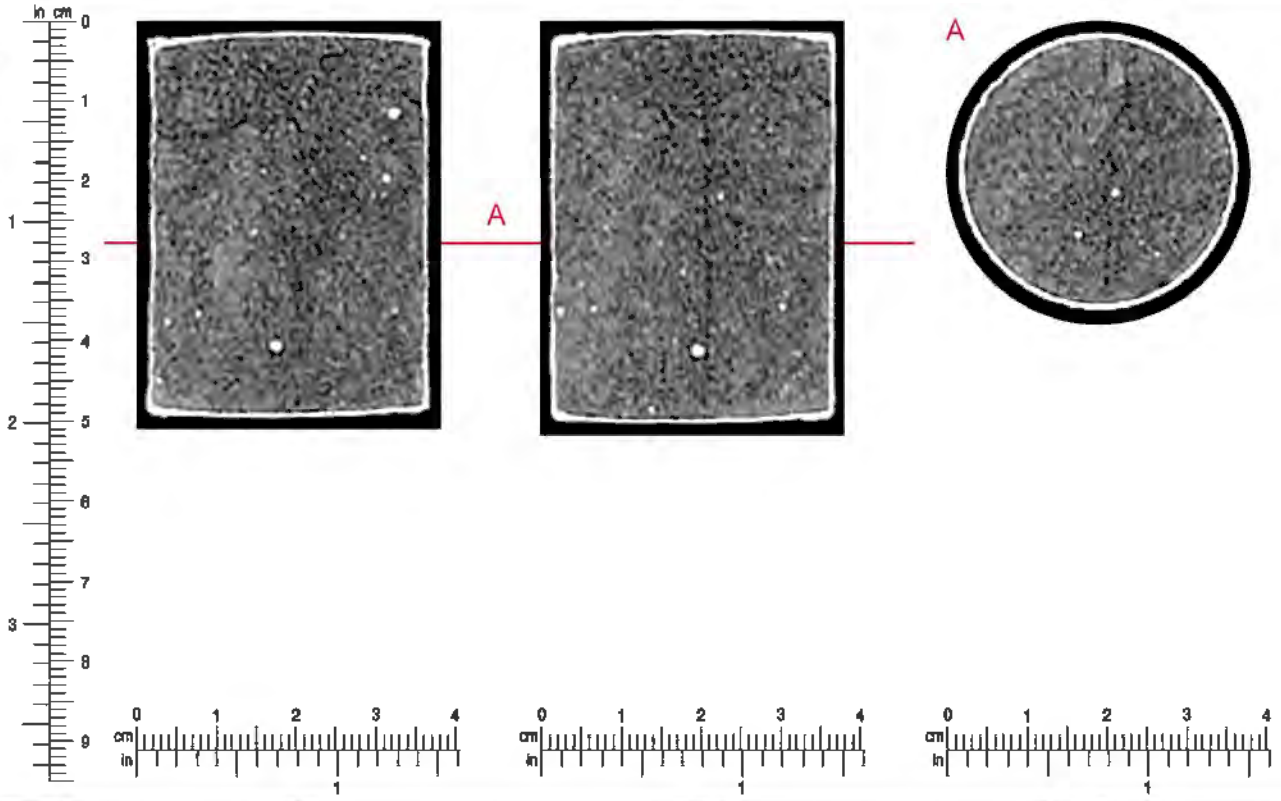
Plug Sample CT Scan

0° 90° Axials

Sample#: 8

Depth (ft):

4768.10

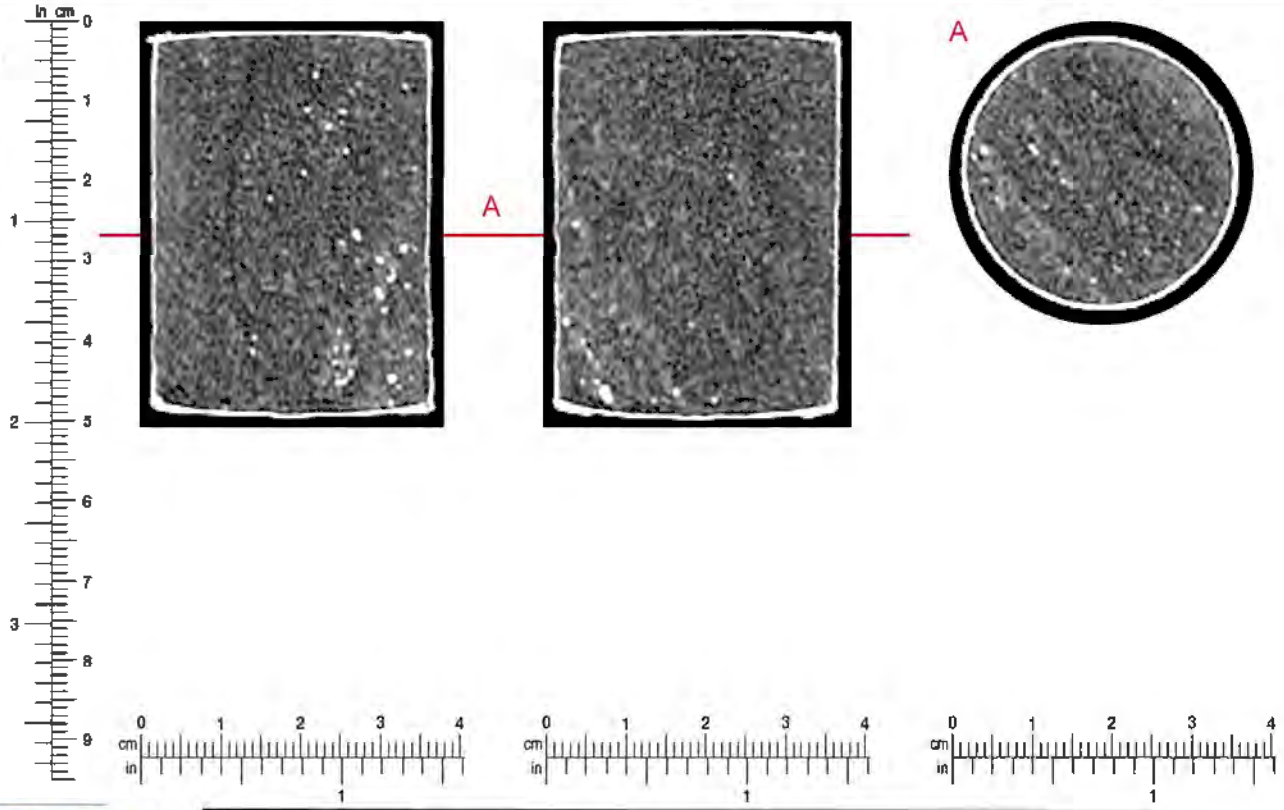


0° 90° Axials

Sample#: 9

Depth (ft):

4774.80



UltraScan

Pacific Gas & Electric Company
Well: Piacentine 2-27
Field: King Island, San Joaquin Co., CA

CL File No.: 313024PG

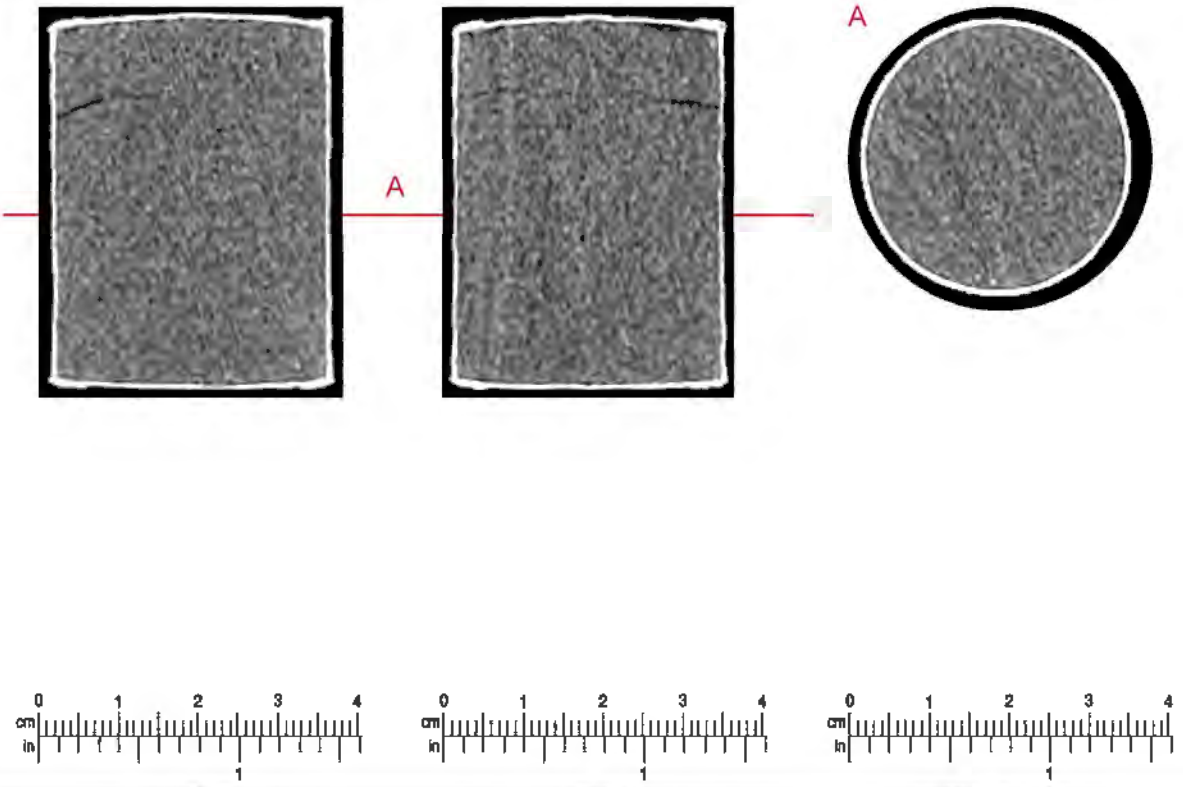
Plug Sample CT Scan

0° 90° Axials

Sample#: 10

Depth (ft):

4781.20

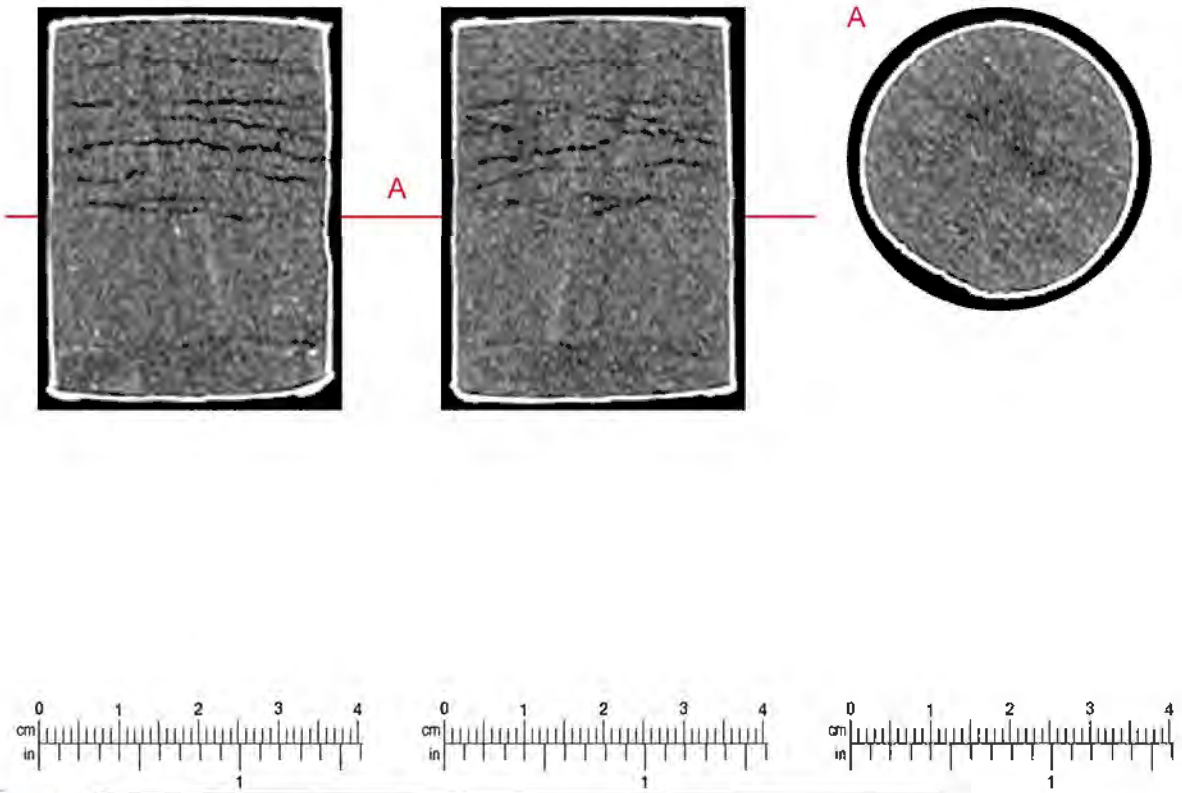


0° 90° Axials

Sample#: 11

Depth (ft):

4784.30



UltraScan

SPECIAL CORE ANALYSIS STUDY

Piacentine 2-27 Well
King Island Field
San Joaquin County

Caprock Analysis Final Report

Performed for:

Pacific Gas and Electric Company
6121 Bollinger Canyon Rd, Rm. 2510C
San Ramon, CA 94583

July 2013

File: 57111-313024PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Fax: 661-325-5808
www.corelab.com

July 3, 2013

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm. 2510C
Ventura, CA 94583

Subject: Advanced Rock Properties Study
File: 57111-313024PG

Dear Mr. Chan:

Enclosed are final Caprock / threshold pressure data for three conventional core samples selected by Pacific Gas and Electric Company personnel from Piacentine 2-27 Well, King Island Field, San Joaquin County, California.

This final report contains the test summary, procedures and measured data.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. If you have any questions concerning the enclosed information, or if we can be of any additional service, please contact me at 661-325-5657.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

Larry Kunkel
Area Manager

CLB Listed NYSE

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

Summary

Caprock / Threshold Pressure

Pacific Gas and Electric personnel selected three samples from the Piacentine core for Caprock testing. 1.0" inch diameter plugs was drilled at the selected sample locations.

The test brine used was based on a geochemical analysis on produced water from the Piacentine 2-27 well. It was filtered and degassed prior to use. Density and viscosity were determined at room temperature.

Table 1 – Synthetic Brine Formula

Salt	g/liter
NaCl	11.589
$NaHCO_3$	0.207
KCl	0.063
Na_2SO_4	0.062
$CaCl_2.2H_2O$	1.577
$MgCl_2.6H_2O$	1.087
	14,375ppm

The native state sample was sleeved and loaded into a hydrostatic coreholder at 2600 psi net confining stress (NCS). The sample was flow through saturated with test brine to ensure complete saturation. Nitrogen gas was injected from the top starting at 100 psi and increasing in 13 steps to 2000 psi maximum pressure. Each step was 30 minutes long and the final 2000 psi step was 60 minutes. Gas pressure and volume of brine produced was recorded and used to calculate the effective water permeability at each injection pressure. After the final step, the sample was cleaned, dried and then basic properties were measured.

All three samples behaved the same in this test. During the initial flow through saturation overnight, there was no brine produced. As the injection pressure increase, there was no brine produced and the effective water permeability was non-detectable. There was no gas breakthrough at the 2000 psi maximum 2000 psi injection pressure.

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

Laboratory Procedures

Fluid Preparation

- Synthetic brine formula (14,375 ppm) was determined using geochemical analysis of produced water from Piacentine 2-27 Well (CL report: 57111-513082PE).
- Formulate synthetic brine using reagent grade chemicals and deionized water evacuated of air and filtered to 0.2 microns.
- Determine density and viscosity of the test brine at ambient temperature using a pycnometer and glass capillary viscometer.

Sample Preparation

- Obtain plug sample at specified location from conventional core using cold nitrogen as the bit coolant.
- Sleeve sample using nickel and 120 mesh end screens and seat at 400 psi stress.

Caprock / Threshold Pressure

- Load sleeved “As Is” sample into hydrostatic core holder at 2600 psi NCS.
- Attempt to flow through saturate with test brine. Maintain a constant upstream pressure overnight and measure volume produced overnight.
- Inject nitrogen gas from the top and monitor volume of brine produced downstream.
- Injection pressures used: 100, 200, 300, 400, 500, 600, 800, 1000, 1200, 1400, 1600, 1800 and 2000 psi.
- Leave at each pressure for 30 minutes and record time, injection pressure and brine volume produced. Check for gas break through.
- At end of 2000 psi step, leave an additional 30 minutes and check for gas break through.
- Unload sample, measure weight out and remove water by Dean-Stark extraction with toluene.
- Dry in humidity-controlled oven at 60°C and 45% RH to stable weight.
- Measure dry weight, grain volume, pore volume and air permeability at 2600 psi NCS.
- Calculate effective brine permeability at each injection pressure.

Caprock Analysis Summary

Temperature: 75°F Fluid: 14,000 ppm Synthetic Formation Brine

PETROLEUM SERVICES

Pacific Gas & Electric Co.

Core Lab File No: 313024PG

Well: Piacentine 2-27

Field: King Island

Sample ID	Depth feet	Net Confining Stress* psi	Sample Orientation	Sample Length cm	Sample Area cm^2	Grain Density g/cc	Porosity fract.	Permeability to Air md	Effective Permeability to Brine * md	Threshold Pressure ** psi	Description (companion sample)
1	4657.00	2600	Vertical	3.535	4.858	2.65	0.250	7.18	<0.0001	>2000	Cly gy slty calc
2	4667.00	2600	Vertical	2.995	4.909	2.67	0.219	0.077	<0.0001	>2000	Cly gy slty calc
3	4676.00	2600	Vertical	2.985	4.964	2.72	0.279	0.432	<0.0001	>2000	Mdst gy-grn sdy vslty calc fos

* Permeability to brine is calculated from the brine flow (displacement) as a result of gas injection. There was no brine produced during these three tests.

** Nitrogen gas had not broken through the samples after one hour at 2000 psi

Caprock Analysis

Temperature: 75°F Fluid: 14,000 ppm Synthetic Formation Brine

PETROLEUM SERVICES

Pacific Gas & Electric Co.

Well: Piacentine 2-27

Field: King Island

Core Lab File No: 313024PG

Sample ID	Depth feet	Net Confining Stress* psi	Sample Orientation	Sample Length cm	Sample Area cm^2	Grain Density g/cc	Porosity fract.	Permeability to Air md	Injection Pressure md	Effective Permeability to Brine * md	Description (companion sample)
1	4657.00	2600	Vertical	3.535	4.858	2.65	0.250	7.18	100	<0.0001	Cly gy slty calc
									200	<0.0001	
									300	<0.0001	
									400	<0.0001	
									500	<0.0001	
									600	<0.0001	
									800	<0.0001	
									1000	<0.0001	
									1200	<0.0001	
									1400	<0.0001	
									1600	<0.0001	
									1800	<0.0001	
									2000	<0.0001	

* Permeability to brine is calculated from the brine flow (displacement) as a result of gas injection. There was no brine produced during this test.

** Nitrogen gas had not broken through the sample after one hour at 2000 psi

Caprock Analysis

Temperature: 75°F Fluid: 14,000 ppm Synthetic Formation Brine

PETROLEUM SERVICES

Pacific Gas & Electric Co.

Well: Piacentine 2-27

Field: King Island

Core Lab File No: 313024PG

Sample ID	Depth feet	Net Confining Stress* psi	Sample Orientation	Sample Length cm	Sample Area cm^2	Grain Density g/cc	Porosity fract.	Permeability to Air md	Injection Pressure md	Effective Permeability to Brine * md	Description (companion sample)
2	4667.00	2600	Vertical	2.995	4.909	2.67	0.219	0.077	100	<0.0001	Cly gy slty calc
									200	<0.0001	
									300	<0.0001	
									400	<0.0001	
									500	<0.0001	
									600	<0.0001	
									800	<0.0001	
									1000	<0.0001	
									1200	<0.0001	
									1400	<0.0001	
									1600	<0.0001	
									1800	<0.0001	
									2000	<0.0001	

* Permeability to brine is calculated from the brine flow (displacement) as a result of gas injection. There was no brine produced during this test.

** Nitrogen gas had not broken through the sample after one hour at 2000 psi

Caprock Analysis

Temperature: 75°F Fluid: 14,000 ppm Synthetic Formation Brine

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Pacific Gas & Electric Co.

Well: Piacentine 2-27
Field: King Island

Core Lab File No: 313024PG

Sample ID	Depth feet	Net Confining Stress* psi	Sample Orientation	Sample Length cm	Sample Area cm^2	Grain Density g/cc	Porosity fract.	Permeability to Air md	Injection Pressure md	Effective Permeability to Brine * md	Description (companion sample)
3	4676.00	2600	Vertical	2.985	4.964	2.72	0.279	0.432	100	<0.0001	Mdst gy-grn sdy vslty calc fos
									200	<0.0001	
									300	<0.0001	
									400	<0.0001	
									500	<0.0001	
									600	<0.0001	
									800	<0.0001	
									1000	<0.0001	
									1200	<0.0001	
									1400	<0.0001	
									1600	<0.0001	
									1800	<0.0001	
									2000	<0.0001	

* Permeability to brine is calculated from the brine flow (displacement) as a result of gas injection. There was no brine produced during this test.

** Nitrogen gas had not broken through the sample after one hour at 2000 psi

SPECIAL CORE ANALYSIS STUDY

Piacentine 2-27 Well
King Island Field
San Joaquin County

CRITICAL VELOCITY REPORT

Performed for:

Pacific Gas and Electric Company
6121 Bollinger Canyon Rd, Rm. 2510C
San Ramon, CA 94583

November 2013

File: 57111-313024PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Core Lab
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November 25, 2013

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm. 2510C
Ventura, CA 94583

Subject: Advanced Rock Properties Study
File: 57111-313024PG

Dear Mr. Chan:

Enclosed are final Critical Velocity data for three conventional core samples selected by Pacific Gas and Electric Company personnel from Piacentine 2-27 Well, King Island Field, San Joaquin County, California.

This final report contains the test summary, procedures, measured data and graphs.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. If you have any questions concerning the enclosed information, or if we can be of any additional service, please contact me at 661-325-5657.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

Larry Kunkel
Area Manager

CLB
Listed
NYSE

Client: Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island

CL File No: 313024PG

Critical Velocity Summary

Pacific Gas and Electric personnel selected three samples from the Piacentine 2-27 core for Critical Velocity testing. 1.5" inch diameter plugs was drilled at the selected sample locations. The samples were encapsulated using nickel and screens and then the sleeve was seated. The "as is" samples (no cleaning) were vacuum saturated with synthetic formation brine (Table 1).

Table 1 – Synthetic Brine Formula

Salt	g/liter
NaCl	11.589
$NaHCO_3$	0.207
KCl	0.063
Na_2SO_4	0.062
$CaCl_2.2H_2O$	1.577
$MgCl_2.6H_2O$	1.087
	14,375ppm

The samples were loaded in hydrostatic cells at 2600 psi net confining stress (NCS). The samples were flow through saturated at a low flow rate and 500 psi back pressure to ensure complete saturation. Test brine was injected at six increasing rates (1, 2, 4, 6, 8 and 10 cc/min) for approximately five pore volumes each. Time, volume, and differential pressure were incrementally recorded at each rate to calculate the specific permeability which is summarized below in Table 2. If permeability decreased greater than 10% between rates, reverse flow to check for fines migration (not necessary for these samples). At the conclusion of testing, samples were cleaned, dried and had basic properties measured at NCS.

Table 2 - Permeability to Test Brine at Various Flow Rates

Sample No.	Depth, ft.	Total Porosity, fraction	Permeability to Air, md	Average Specific Brine Permeability, md					
				1.0 cc/min	2.0 cc/min	4.0 cc/min	6.0 cc/min	8.0 cc/min	10.0 cc/min
12	4756.2	0.294	1127	431	476	507	534	527	538
13	4770.9	0.279	3118	3217	3070	2897	2750	2709	2681
14	4776.7	0.278	2233	1440	1466	1440	1395	1383	1379

Sample 4756.2 permeability increased approximately 25% from initial (1cc/min) to final rate. Sample 4770.9 decreased approximately 17% in permeability. Sample 4776.7 decreased approximately 4%. There was no significant change in permeability between rates in these three samples.

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

Critical Velocity Test Procedures

Fluid Preparation

- Synthetic brine formula (14,375 ppm) was determined using geochemical analysis of produced water from Piacentine 2-27 Well (CL report: 57111-513082PE).
- Formulate synthetic brine using reagent grade chemicals and deionized water evacuated of air and filtered to 0.2 microns.
- Determine density and viscosity of the test brine at ambient temperature using a pycnometer and glass capillary viscometer.

Sample Preparation

- Obtain plug samples at specified locations from conventional core using cold nitrogen vapor as the bit coolant. Sleeve plugs using nickel and 120 mesh end screens.
- Seat sleeve at 400 psi stress.
- Test samples “as is” with no initial cleaning or drying.
- Vacuum saturate samples with test brine.
- Load sample into a hydrostatic cell at 2600 psi NCS.
- Flow through saturate samples with test brine at low flow rate (0.5cc/min), ambient temperature and 500 psi back pressure to ensure complete saturation.

Critical Velocity

- Slowly remove back pressure and start test.
- Inject approximately five pore volumes of test brine at a constant rate of 1.0 cc/min.
- Record incremental readings of time, volume, and differential pressure to calculate permeability.
- Repeat the process for 2, 4, 6, 8 and 10 cc/min while keeping the same injection volume.
- If permeability decreases more than 10% between rates, reverse flow and check for fines migration.
- Calculate and plot incremental brine permeability as a function of pore volumes injected.

Basic Properties

- Unload sample and clean by Soxhlet extraction with methylene chloride–methanol mixture.
- Vacuum dry sample at 140°F until weight is stable.
- Determine basic properties of grain volume, pore volume and air permeability at 2600 psi NCS.

BASIC PROPERTIES SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.** CL File No.: 313024PG
Well: Piacentine 2-27
Field: King Island

Sample Number	Depth ft	Net Confining Stress psi	Textural Description from Routine data	Porosity fraction	Grain Density g/cc	Permeability to Air md
12	4756.20	2600	Sd gy vf-fgr sslty smica	0.294	2.64	1127
13	4770.90	2600	Sd gy vf-mgr sslty smica	0.279	2.64	3118
14	4776.70	2600	Sd gy vf-mgr sslty smica	0.278	2.64	2233

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	12
Sample Depth, feet:	4756.20
Permeability to Air, md:	1127
Average Base Saturant Permeability, md:	436
Porosity, fraction:	0.294
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
1.0 cc/min	7.29	0.35	445	1.02
	7.63	0.69	444	1.02
	7.98	1.04	442	1.01
	8.33	1.39	441	1.01
	8.67	1.73	440	1.01
	9.02	2.08	440	1.01
	9.37	2.43	439	1.01
	9.72	2.78	437	1.00
	10.06	3.12	435	1.00
	10.41	3.47	435	1.00
	10.76	3.82	434	1.00
	11.10	4.16	433	0.99
	11.45	4.51	432	0.99
	11.80	4.86	432	0.99
	12.14	5.20	432	0.99
	12.49	5.55	431	0.99
	12.84	5.90	431	0.99
	13.19	6.25	431	0.99
	13.53	6.59	431	0.99
	13.88	6.94	431	0.99
2.0 cc/min	14.23	7.29	497	1.14
	14.57	7.63	494	1.13
	14.92	7.98	491	1.13
	15.27	8.33	489	1.12
	15.61	8.67	486	1.12
	15.96	9.02	485	1.11
	16.31	9.37	484	1.11
	16.66	9.72	482	1.11
	17.00	10.06	481	1.10
	17.35	10.41	480	1.10
	17.70	10.76	479	1.10
	18.04	11.10	478	1.10
	18.39	11.45	478	1.10
	18.74	11.80	478	1.10
	19.08	12.14	477	1.09
	19.43	12.49	477	1.09
	19.78	12.84	476	1.09
	20.13	13.19	476	1.09
	20.47	13.53	476	1.09
	20.82	13.88	476	1.09

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	12
Sample Depth, feet:	4756.20
Permeability to Air, md:	1127
Average Base Saturant Permeability, md:	436
Porosity, fraction:	0.294
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
4.0 cc/min	21.17	14.23	526	1.21
	21.51	14.57	524	1.20
	21.86	14.92	523	1.20
	22.21	15.27	522	1.20
	22.55	15.61	516	1.18
	22.90	15.96	514	1.18
	23.25	16.31	513	1.18
	23.60	16.66	512	1.18
	23.94	17.00	512	1.17
	24.29	17.35	511	1.17
	24.64	17.70	510	1.17
	24.98	18.04	510	1.17
	25.33	18.39	510	1.17
	25.68	18.74	510	1.17
	26.02	19.08	509	1.17
	26.37	19.43	509	1.17
	26.72	19.78	509	1.17
	27.07	20.13	508	1.17
	27.41	20.47	507	1.16
	27.76	20.82	507	1.16
6.0 cc/min	28.10	21.17	528	1.21
	28.45	21.51	531	1.22
	28.80	21.86	529	1.21
	29.14	22.20	530	1.21
	29.49	22.55	530	1.22
	29.83	22.89	527	1.21
	30.18	23.24	526	1.21
	30.52	23.58	529	1.21
	30.87	23.93	531	1.22
	31.22	24.28	536	1.23
	31.56	24.62	537	1.23
	31.91	24.97	540	1.24
	32.25	25.31	540	1.24
	32.60	25.66	542	1.24
	32.94	26.00	541	1.24
	33.29	26.35	541	1.24
	33.63	26.69	541	1.24
	33.98	27.04	539	1.24
	34.33	27.39	538	1.23
	34.67	27.73	534	1.23

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	12
Sample Depth, feet:	4756.20
Permeability to Air, md:	1127
Average Base Saturant Permeability, md:	436
Porosity, fraction:	0.294
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
8.0 cc/min	35.02	28.08	548	1.26
	35.37	28.43	546	1.25
	35.72	28.78	548	1.26
	36.07	29.13	549	1.26
	36.42	29.48	549	1.26
	36.77	29.83	547	1.26
	37.12	30.18	549	1.26
	37.47	30.53	549	1.26
	37.82	30.88	550	1.26
	38.17	31.23	549	1.26
	38.52	31.58	544	1.25
	38.87	31.93	543	1.25
	39.22	32.28	542	1.24
	39.57	32.63	538	1.23
	39.92	32.98	536	1.23
	40.27	33.33	535	1.23
	40.62	33.68	533	1.22
	40.97	34.03	529	1.21
	41.32	34.38	529	1.21
	41.67	34.73	527	1.21
10.0 cc/min	42.01	35.07	548	1.26
	42.36	35.42	547	1.25
	42.71	35.77	543	1.25
	43.05	36.11	547	1.25
	43.40	36.46	541	1.24
	43.75	36.81	546	1.25
	44.10	37.16	543	1.25
	44.44	37.50	540	1.24
	44.79	37.85	545	1.25
	45.14	38.20	543	1.25
	45.48	38.54	542	1.24
	45.83	38.89	543	1.25
	46.18	39.24	541	1.24
	46.52	39.58	539	1.24
	46.87	39.93	539	1.24
	47.22	40.28	540	1.24
	47.57	40.63	535	1.23
	47.91	40.97	534	1.23
	48.26	41.32	536	1.23
	48.61	41.67	538	1.23

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

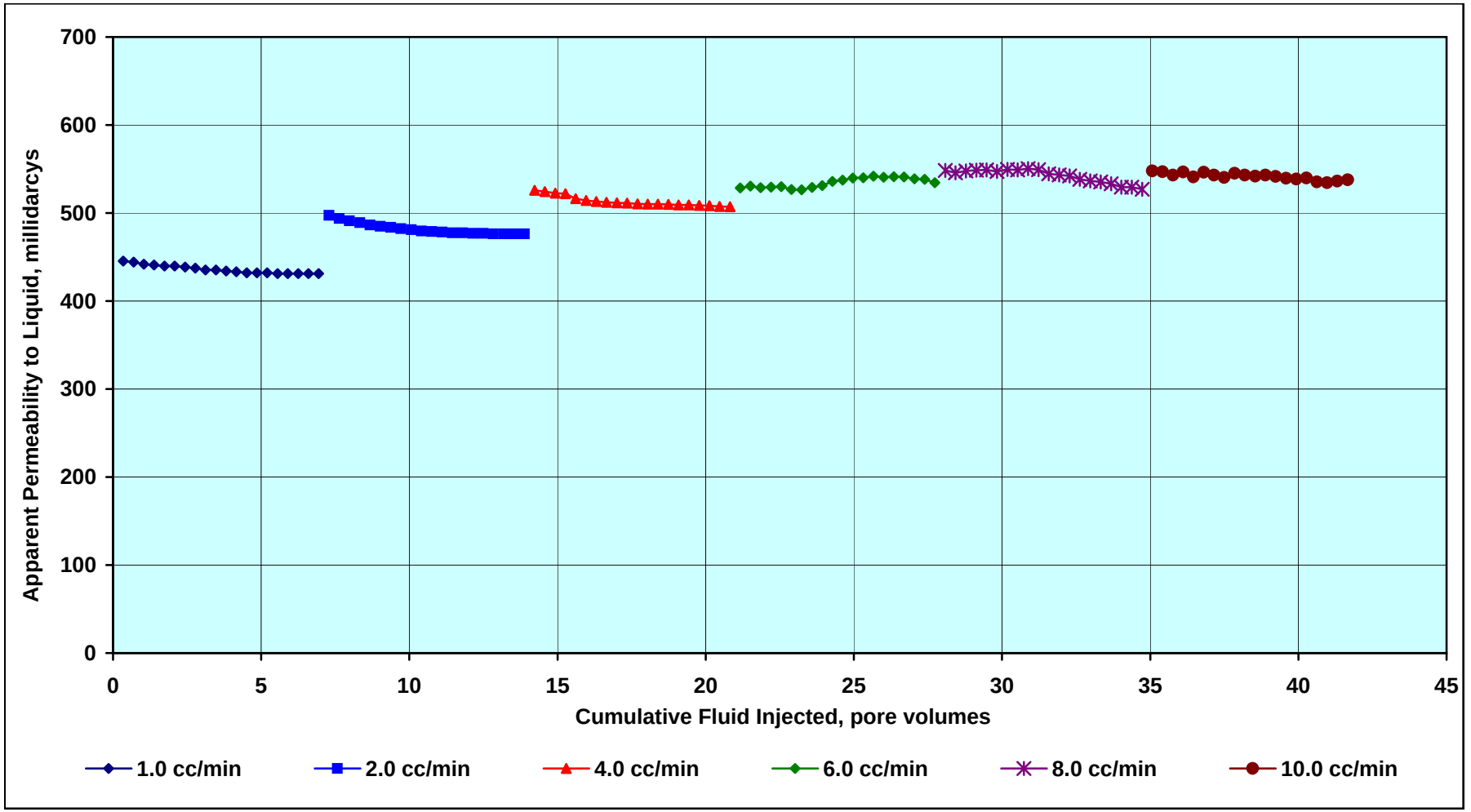
Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	12
Sample Depth, feet:	4756.20
Permeability to Air, md:	1127
Porosity, fraction:	0.294



Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	13
Sample Depth, feet:	4770.9
Permeability to Air, md:	3118
Average Base Saturant Permeability, md:	3239
Porosity, fraction:	0.279
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
1.0 cc/min	0.37	0.37	3280	1.01
	0.74	0.74	3280	1.01
	1.11	1.11	3280	1.01
	1.48	1.48	3280	1.01
	1.85	1.85	3280	1.01
	2.22	2.22	3280	1.01
	2.59	2.59	3255	1.00
	2.96	2.96	3242	1.00
	3.33	3.33	3217	0.99
	3.70	3.70	3217	0.99
	4.07	4.07	3217	0.99
	4.44	4.44	3217	0.99
	4.81	4.81	3217	0.99
	5.19	5.19	3217	0.99
	5.56	5.56	3217	0.99
	5.93	5.93	3217	0.99
	6.30	6.30	3217	0.99
	6.67	6.67	3217	0.99
	7.04	7.04	3217	0.99
	7.41	7.41	3217	0.99
2.0 cc/min	7.78	7.78	3157	0.97
	8.15	8.15	3127	0.97
	8.52	8.52	3127	0.97
	8.89	8.89	3127	0.97
	9.26	9.26	3127	0.97
	9.63	9.63	3127	0.97
	10.00	10.00	3127	0.97
	10.37	10.37	3127	0.97
	10.74	10.74	3127	0.97
	11.11	11.11	3098	0.96
	11.48	11.48	3098	0.96
	11.85	11.85	3098	0.96
	12.22	12.22	3098	0.96
	12.59	12.59	3098	0.96
	12.96	12.96	3098	0.96
	13.33	13.33	3070	0.95
	13.70	13.70	3070	0.95
	14.07	14.07	3070	0.95
	14.44	14.44	3070	0.95
	14.82	14.82	3070	0.95

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	13
Sample Depth, feet:	4770.9
Permeability to Air, md:	3118
Average Base Saturant Permeability, md:	3239
Porosity, fraction:	0.279
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
4.0 cc/min	15.19	15.19	3014	0.93
	15.56	15.56	2974	0.92
	15.93	15.93	2948	0.91
	16.30	16.30	2935	0.91
	16.67	16.67	2922	0.90
	17.04	17.04	2922	0.90
	17.41	17.41	2910	0.90
	17.78	17.78	2910	0.90
	18.15	18.15	2910	0.90
	18.52	18.52	2910	0.90
	18.89	18.89	2910	0.90
	19.26	19.26	2910	0.90
	19.63	19.63	2910	0.90
	20.00	20.00	2910	0.90
	20.37	20.37	2897	0.89
	20.74	20.74	2897	0.89
	21.11	21.11	2897	0.89
	21.48	21.48	2897	0.89
	21.85	21.85	2897	0.89
	22.22	22.22	2897	0.89
6.0 cc/min	22.59	22.59	2868	0.89
	22.96	22.96	2852	0.88
	23.33	23.33	2812	0.87
	23.70	23.70	2796	0.86
	24.07	24.07	2788	0.86
	24.44	24.44	2781	0.86
	24.80	24.80	2781	0.86
	25.17	25.17	2765	0.85
	25.54	25.54	2765	0.85
	25.91	25.91	2765	0.85
	26.28	26.28	2765	0.85
	26.65	26.65	2758	0.85
	27.02	27.02	2758	0.85
	27.39	27.39	2758	0.85
	27.76	27.76	2758	0.85
	28.13	28.13	2758	0.85
	28.49	28.49	2758	0.85
	28.86	28.86	2750	0.85
	29.23	29.23	2750	0.85
	29.60	29.60	2750	0.85

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	13
Sample Depth, feet:	4770.9
Permeability to Air, md:	3118
Average Base Saturant Permeability, md:	3239
Porosity, fraction:	0.279
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
8.0 cc/min	29.97	29.97	2788	0.86
	30.35	30.35	2771	0.86
	30.72	30.72	2765	0.85
	31.09	31.09	2748	0.85
	31.47	31.47	2737	0.84
	31.84	31.84	2737	0.84
	32.21	32.21	2737	0.84
	32.59	32.59	2731	0.84
	32.96	32.96	2731	0.84
	33.33	33.33	2726	0.84
	33.71	33.71	2726	0.84
	34.08	34.08	2720	0.84
	34.45	34.45	2720	0.84
	34.83	34.83	2715	0.84
	35.20	35.20	2715	0.84
	35.57	35.57	2715	0.84
	35.95	35.95	2715	0.84
	36.32	36.32	2709	0.84
	36.69	36.69	2709	0.84
	37.07	37.07	2709	0.84
10.0 cc/min	37.44	37.44	2770	0.86
	37.81	37.81	2752	0.85
	38.18	38.18	2752	0.85
	38.55	38.55	2734	0.84
	38.92	38.92	2725	0.84
	39.29	39.29	2712	0.84
	39.66	39.66	2712	0.84
	40.03	40.03	2707	0.84
	40.40	40.40	2703	0.83
	40.77	40.77	2698	0.83
	41.14	41.14	2694	0.83
	41.51	41.51	2694	0.83
	41.88	41.88	2690	0.83
	42.25	42.25	2690	0.83
	42.62	42.62	2690	0.83
	42.99	42.99	2685	0.83
	43.36	43.36	2685	0.83
	43.73	43.73	2681	0.83
	44.10	44.10	2681	0.83
	44.48	44.48	2681	0.83

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

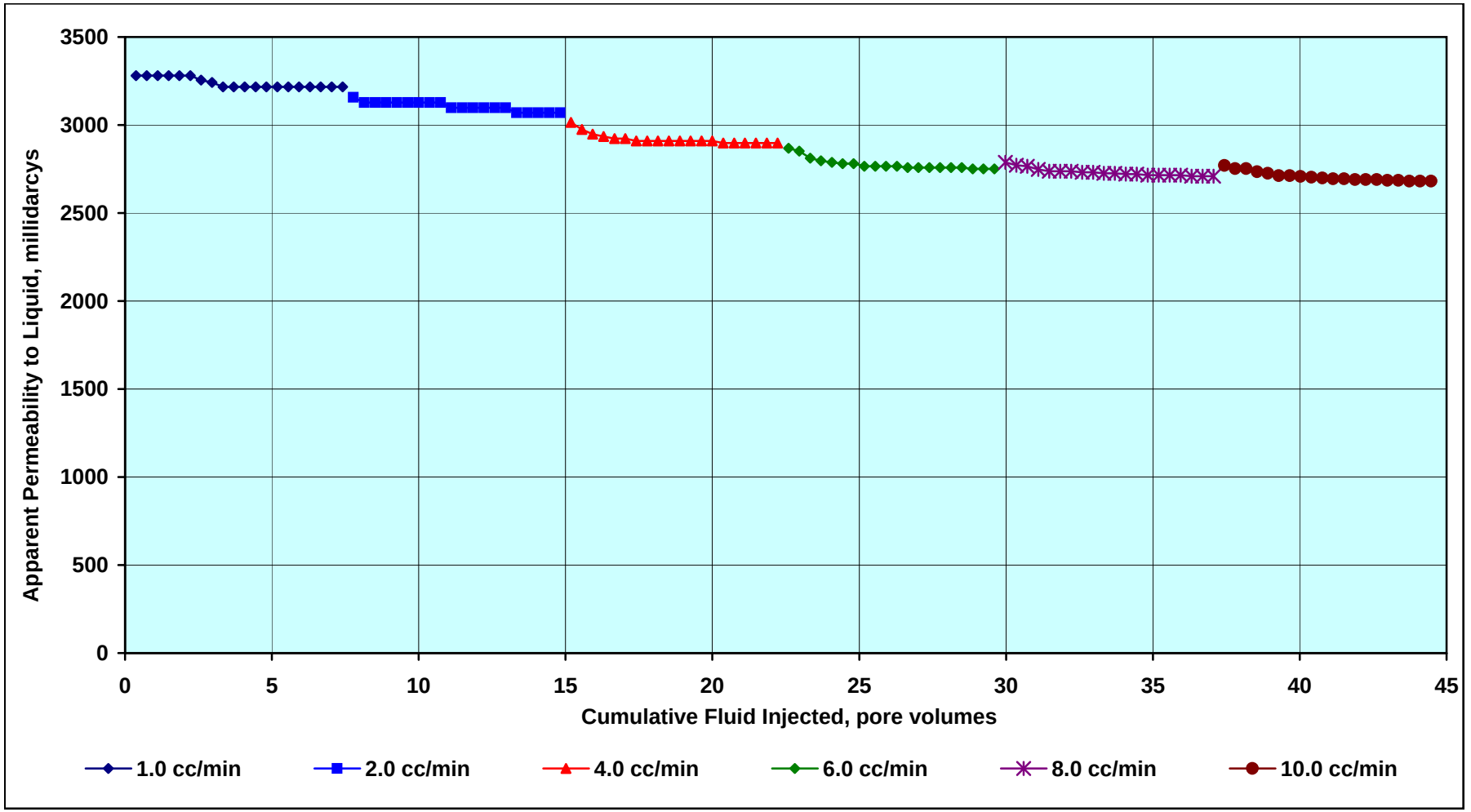
Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	13
Sample Depth, feet:	4770.90
Permeability to Air, md:	3118
Porosity, fraction:	0.279



Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	14
Sample Depth, feet:	4776.7
Permeability to Air, md:	2233
Average Base Saturant Permeability, md:	1443
Porosity, fraction:	0.278
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
1.0 cc/min	0.43	0.43	1466	1.02
	0.87	0.87	1466	1.02
	1.30	1.30	1453	1.01
	1.73	1.73	1446	1.00
	2.16	2.16	1440	1.00
	2.60	2.60	1440	1.00
	3.03	3.03	1440	1.00
	3.46	3.46	1440	1.00
	3.90	3.90	1440	1.00
	4.33	4.33	1435	0.99
	4.76	4.76	1435	0.99
	5.19	5.19	1440	1.00
	5.63	5.63	1440	1.00
	6.06	6.06	1440	1.00
	6.49	6.49	1440	1.00
	6.93	6.93	1440	1.00
	7.36	7.36	1440	1.00
	7.79	7.79	1440	1.00
	8.23	8.23	1440	1.00
	8.66	8.66	1440	1.00
2.0 cc/min	0.43	9.09	1486	1.03
	0.87	9.52	1486	1.03
	1.30	9.96	1479	1.03
	1.73	10.39	1479	1.03
	2.16	10.82	1472	1.02
	2.60	11.26	1472	1.02
	3.03	11.69	1472	1.02
	3.46	12.12	1472	1.02
	3.90	12.55	1472	1.02
	4.33	12.99	1472	1.02
	4.76	13.42	1472	1.02
	5.19	13.85	1472	1.02
	5.63	14.29	1466	1.02
	6.06	14.72	1466	1.02
	6.49	15.15	1466	1.02
	6.93	15.58	1466	1.02
	7.36	16.02	1466	1.02
	7.79	16.45	1466	1.02
	8.23	16.88	1466	1.02
	8.66	17.32	1466	1.02

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	14
Sample Depth, feet:	4776.7
Permeability to Air, md:	2233
Average Base Saturant Permeability, md:	1443
Porosity, fraction:	0.278
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
4.0 cc/min	0.43	17.75	1469	1.02
	0.87	18.18	1466	1.02
	1.30	18.62	1462	1.01
	1.73	19.05	1459	1.01
	2.16	19.48	1456	1.01
	2.60	19.91	1453	1.01
	3.03	20.35	1449	1.00
	3.46	20.78	1449	1.00
	3.90	21.21	1446	1.00
	4.33	21.65	1446	1.00
	4.76	22.08	1443	1.00
	5.19	22.51	1443	1.00
	5.63	22.94	1443	1.00
	6.06	23.38	1443	1.00
	6.49	23.81	1443	1.00
	6.93	24.24	1443	1.00
	7.36	24.68	1440	1.00
	7.79	25.11	1440	1.00
	8.23	25.54	1440	1.00
	8.66	25.97	1440	1.00
6.0 cc/min	0.43	26.41	1446	1.00
	0.86	26.84	1429	0.99
	1.29	27.27	1419	0.98
	1.72	27.70	1417	0.98
	2.16	28.13	1409	0.98
	2.59	28.56	1407	0.97
	3.02	28.99	1405	0.97
	3.45	29.42	1405	0.97
	3.88	29.86	1403	0.97
	4.31	30.29	1403	0.97
	4.74	30.72	1403	0.97
	5.17	31.15	1403	0.97
	5.61	31.58	1401	0.97
	6.04	32.01	1401	0.97
	6.47	32.44	1399	0.97
	6.90	32.87	1397	0.97
	7.33	33.30	1395	0.97
	7.76	33.74	1395	0.97
	8.19	34.17	1395	0.97
	8.62	34.60	1395	0.97

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	14
Sample Depth, feet:	4776.7
Permeability to Air, md:	2233
Average Base Saturant Permeability, md:	1443
Porosity, fraction:	0.278
Base Saturant:	14,375 ppm Syn. Brine

Injection Rate	Cumulative Fluid Injected, pore volumes		Apparent Permeability to Liquid md	Permeability / Avg. Base Saturant Perm. Ratio
	fluid	total		
8.0 cc/min	0.44	35.03	1429	0.99
	0.87	35.47	1422	0.99
	1.31	35.91	1419	0.98
	1.75	36.34	1416	0.98
	2.18	36.78	1407	0.98
	2.62	37.22	1401	0.97
	3.05	37.65	1398	0.97
	3.49	38.09	1395	0.97
	3.93	38.53	1394	0.97
	4.36	38.96	1392	0.96
	4.80	39.40	1392	0.96
	5.24	39.83	1391	0.96
	5.67	40.27	1389	0.96
	6.11	40.71	1386	0.96
	6.55	41.14	1386	0.96
	6.98	41.58	1386	0.96
	7.42	42.02	1386	0.96
	7.85	42.45	1385	0.96
	8.29	42.89	1385	0.96
	8.73	43.33	1383	0.96
10.0 cc/min	0.43	43.76	1421	0.98
	0.87	44.19	1421	0.98
	1.30	44.62	1416	0.98
	1.73	45.06	1415	0.98
	2.16	45.49	1413	0.98
	2.60	45.92	1409	0.98
	3.03	46.36	1403	0.97
	3.46	46.79	1399	0.97
	3.90	47.22	1397	0.97
	4.33	47.65	1395	0.97
	4.76	48.09	1393	0.97
	5.19	48.52	1391	0.96
	5.63	48.95	1389	0.96
	6.06	49.39	1388	0.96
	6.49	49.82	1387	0.96
	6.93	50.25	1385	0.96
	7.36	50.68	1382	0.96
	7.79	51.12	1382	0.96
	8.23	51.55	1380	0.96
	8.66	51.98	1379	0.96

Core Lab
RESERVOIR OPTIMIZATION

PERMEABILITY VERSUS INJECTION RATE

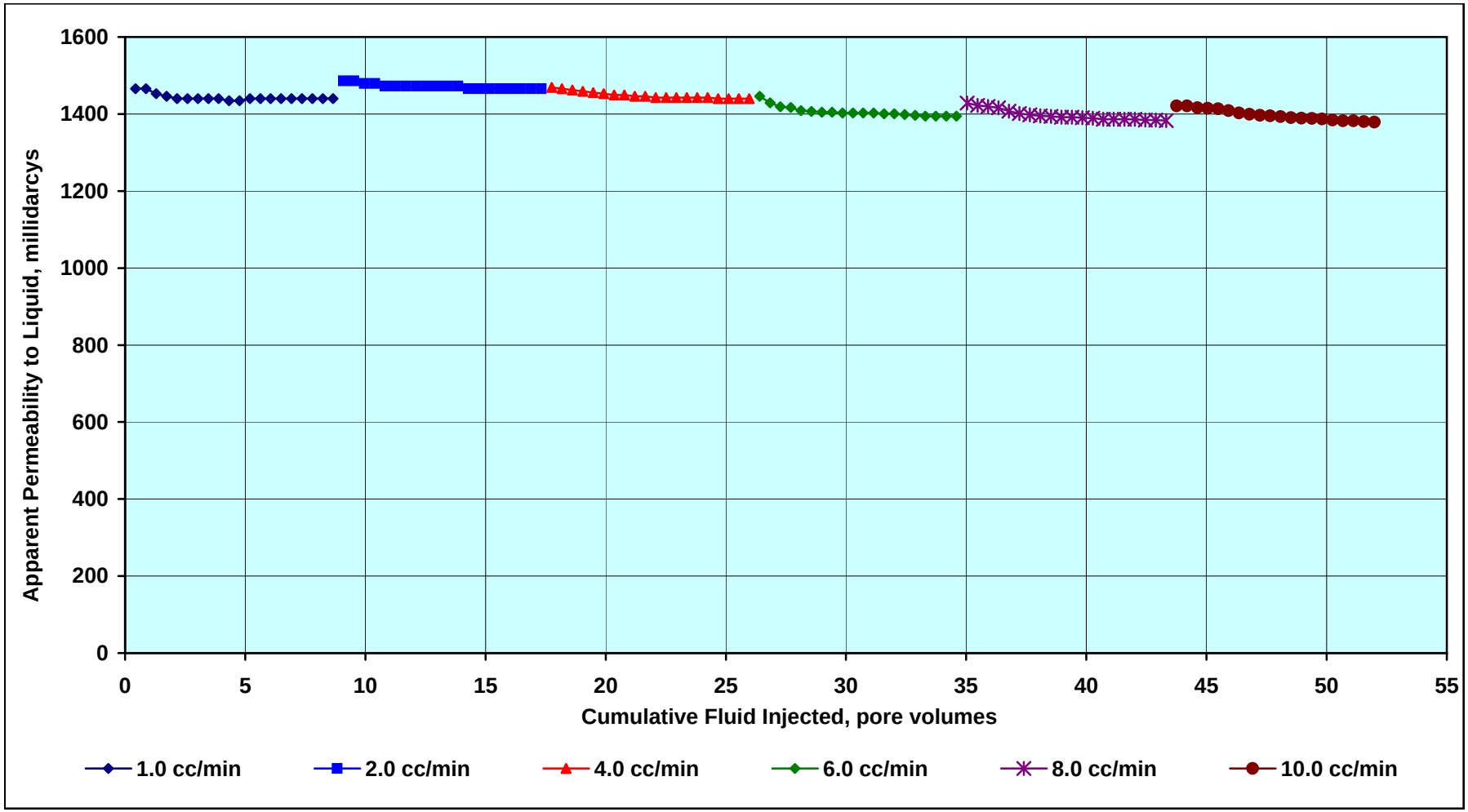
Native-State Sample

Temperature: ambient Net Confining Stress: 2600 psi

PETROLEUM SERVICES

Company: **Pacific Gas and Electric Co.**
Well: Piacentine 2-27
Field: King Island

Core Lab File No:	313024PG
Sample Number:	14
Sample Depth, feet:	4776.70
Permeability to Air, md:	2233
Porosity, fraction:	0.278



SPECIAL CORE ANALYSIS STUDY

Piacentine 2-27 Well
King Island Field
San Joaquin County

High Pressure Mercury Injection Report

Performed for:

Pacific Gas and Electric Company
6121 Bollinger Canyon Rd, Rm. 2510C
San Ramon, CA 94583

August 2013

File: 57111-313024PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Core Lab
RESERVOIR OPTIMIZATION

Petroleum Services Division
3437 Landco Dr.
Bakersfield, California 93308
Tel: 661-325-5657
Fax: 661-325-5808
www.corelab.com

August 19, 2013

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm. 2510C
Ventura, CA 94583

Subject: Advanced Rock Properties Study
File: 57111-313024PG

Dear Mr. Chan:

Enclosed are final High Pressure Mercury Injection data for six conventional core samples selected by Pacific Gas and Electric Company personnel from Piacentine 2-27 Well, King Island Field, San Joaquin County, California.

This final report contains the test summary, procedures and measured data. A discussion of the test results follows this letter.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. If you have any questions concerning the enclosed information, or if we can be of any additional service, please contact me at 661-325-5657.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

Larry Kunkel
Area Manager

CLB
NYSE

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

SUMMARY OF RESULTS

The Houston Advanced Technology Center of Core Laboratories received six (6) core material samples from the Piacentine 2-27 well for mercury injection analysis. The samples were placed within the glass penetrometers of the Micromeritics AutoPore mercury injection instrument for high pressure mercury injection analysis. A permeability value was calculated from the mercury injection results using the methods of Swanson, B.F. ("A Simple Correlation Between Permeabilities and Mercury Capillary Pressures" Journal of Petroleum Technology, December 1981). The table below gives a brief summary of sample properties and the mercury injection test results.

High Pressure Mercury Injection

Sample Numbe	Sample Depth, Ft	Swanson Permeability, md	Porosity, fraction	Approximate Threshold Pressure, psi	Median Pore Throat Radius, µm
1	4725.8	436	0.323	1.9	4.97
2A	4756.8	1200	0.344	3.8	11.40
3A	4768.3	1050	0.306	3.3	12.50
4A	4774.3	1100	0.289	3.8	13.60
5A	4780.9	2080	0.367	2.3	15.50
6	4783.9	316	0.295	2.4	4.52

Apparent mercury injection volumes were corrected using a conformance factor determined for each sample from an evaluation of a plot of the apparent injection volume versus injection pressure. As an extremely non-wetting material, mercury must be forced with pressure to conform around and into surface features. The conformance value is the volume of mercury pressed into surface roughness and around sample edges after the penetrometer chamber is initially filled with mercury. This conformance volume is subtracted from all subsequent apparent injection volumes. Mercury injection data are presented in tabular and graphic form following this discussion. The tabular data include: the injection pressure, mercury saturation, conversions of pressure to other laboratory systems, and estimated height above free water level.

The injection pressures generated by the Micromeritics instrument allow the full capillary pressure curve to be generated for the rock material tested. The range of equivalent water saturations expected within a given reservoir as defined by that curve will depend on the relationship of the tested rock type to its position with respect to Free Water Level.

Pore throat size distribution was calculated from the mercury injection test results. These data are typically used for pore geometry characterizations and comparisons. The pore throat size distributions can often help to evaluate the results of other analyses performed on the same, or similar companion, samples. It can also aid in designing filtration requirements for injection

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

projects. Textural effects and pore size distribution are major factors affecting irreducible water saturations, and hence the extent and height of a reservoir's transition zone.

In general, pore throat radii can be divided into several categories which can be used in the classification and grouping of the test samples. Microporosity is often defined as pore throat radii of less than 0.50 microns. The following classification is utilized for this discussion:

Classification Number	Pore Radius Classification	Pore Radius, microns Minimum	Maximum
1	nano	<0.0025	0.10
2	micro	0.10	0.75
3	meso	0.75	5.0
4	macro	5.0	25.
5	mega	25.	>100.

These ranges have been included on the pore throat radii histograms.

Additional tabular data include dimensionless Leverett J values and conversions of mercury injection pressures to those of approximately equivalent laboratory capillary pressures representing gas-water, gas-oil, and oil-water fluid systems. Values for interfacial tension (IFT) and contact angle (theta) used to compute fluid system capillary pressure are found in a table following the laboratory procedures. Leverett J values normalize the rock quality (permeability and porosity) and pressure-scaling (IFT and theta) terms. This allows the combination of results from different samples and pressure systems, converting all capillary pressure data to a universal curve that represents a specific formation or zone.

Conversions of air-mercury pressures to other systems can be refined by applying actual measured values in place of the “typical” parameters which are used when measured values are not available.

In order to calculate a corresponding height above free water for the mercury injection data, laboratory data must be converted to equivalent reservoir oil-water or gas-water values and generic fluid density gradients. Ideally, the density gradients should correspond to reservoir values at initial reservoir temperature and pressure. In the standard data presentation, listed height values are entered as *estimated* values because representative reservoir values are typically not made available and standard, “typical” interfacial tension, contact angle, and density gradient parameters are used. Using the “typical” conversion parameters, these values are often reasonable estimates, but significant variation from the actual height relationship is possible. Measured parameter value should be input into the conversion equation whenever possible.

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

LABORATORY PROCEDURES

High Pressure Mercury Injection

1. Testing was performed using the Micromeritics Autopore, an automated, high pressure mercury injection device which operates at injection pressures of 0 to 55,000 psia.
2. The sample was weighed, and then loaded into a glass penetrometer consisting of a sample chamber attached to a capillary stem with a cylindrical coaxial capacitor. Each penetrometer used was selected on the basis of how well its capacity matched the sample pore volume to maximize accuracy and resolution.
3. The sample/penetrometer assembly was weighed, and then placed into the low pressure system.
4. The sample chamber was evacuated and filled with mercury, then the pressure was increased incrementally to slightly above atmospheric pressure. At the end of the low pressure phase the assembly was temporarily removed and re-weighed, then placed into the high pressure side of the apparatus.
5. Pressures were increased incrementally to a maximum of 55,000 psia.
6. Time was allowed at each incremental pressure for saturation equilibrium. The volume of mercury injected at each pressure was determined by the change in capacitance of the capillary stem.
7. The pressure was decreased to ambient and the sample unloaded. A final weight was recorded to calculate the residual mercury saturation.
8. Micromeritics data were imported to a spreadsheet and the mercury volumes calculated. A conformance (correction for surface roughness) value was selected, volume corrections made, and saturations calculated.
9. Pore throat size, fluid system pressure conversion, and height data were calculated using “typical” parameters which are reported at the end of this discussion.

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

Other Calculations

1. Pore entry radii were calculated using the formula:

$$Ri = \frac{2T * \cos\theta * C}{Pc}$$

where:
- Ri = Pore entry radius, microns
- T = Interfacial tension
- θ = Contact angle
- C = Unit conversion constant (to microns) = 0.145
- Pc = Mercury injection pressure, psia.

2. J-Function values are calculated from capillary pressure (or mercury injection) data and basic sample properties using the following equation:

$$\text{J-Function} = \frac{0.2166 * Pc * (K/\phi)^{1/2}}{(T * \cos\theta)}$$

where:
- Pc = Injection pressure, psia
- T = Interfacial tension, dyne/cm
- θ = Contact angle
- K = Permeability to air (or Klinkenberg), millidarcies
- ϕ = Porosity, fraction.
- 0.2166 = Factor used to cancel units and make "J" dimensionless

3. Conversions of pressure from one fluid system to the others are calculated using the example formula:

$$Pc_{(g\text{-}w)} = Pc_{(meas.)} * \frac{(T * \cos\theta)_{(g\text{-}w)}}{(T * \cos\theta)_{(meas.)}}$$

where:
- $Pc_{(g\text{-}w)}$ = Capillary pressure in a gas-water system
- $Pc_{(meas.)}$ = Capillary pressure of the measured fluid system
- T = Interfacial tension
- θ = Contact angle

4. Height above free water is calculated from laboratory capillary pressure data using the following equation:

$$Pc_R = Pc_L * (T\cos\theta)_R \div (T\cos\theta)_L$$
$$\text{Height} = Pc_R \div (\rho_w - \rho_h)$$

where:
- Pc_L = Laboratory measured capillary pressure
- $T\cos\theta_R$ = Interfacial tension * cosine of contact angle (reservoir)
- $T\cos\theta_L$ = Interfacial tension * cosine of contact angle (laboratory)
- ρ_w = Reservoir density gradient, water
- ρ_h = Reservoir density gradient, hydrocarbon
- T = Interfacial tension
- θ = Contact angle

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

SUMMARY OF CALCULATION PARAMETERS

Fluid System	(θ) Contact Angle	cosine Contact θ	(T) Interfacial Tension	T cosine θ
Laboratory				
Gas-water	0.0	1.00	72.0	72.0
Oil-water	30.0	0.866	48.0	41.6
Gas-oil	0.0	1.00	24.0	24.0
Air-mercury	140.	0.765	485.	372.
Reservoir[1]				
Oil-water	30.0	0.866	30.0	26.0
Gas-water	0.0	1.00	50.0	50.0

Density Gradients

water = 0.433
oil = 0.346
gas = 0.100

[1] Reservoir IFT values can vary widely but are typically between 20 and 35 dynes/cm in an oil/water system. Reservoir oil/water theta values are highly variable, with strongly water being an angle of 0° and strongly oil wet being an angle of 120°.

Listed reservoir gas/water values are fairly typical to a depth of approximately 5000 feet. IFT will decrease with increasing depth (increasing temperature and pressure).

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**1m**	un-	Host Plug	
Depth, feet:	4725.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	322.	-
Swanson Permeability, md:		436.	-	-
Porosity, fraction:		0.323	0.316	-
maximum Sb/Pc, fraction:		1.05	-	-
R35, microns:		7.96	-	-
R50 (median pore throat radius):		4.97	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
0.82	0.000	1.000	131	0.0176	0.159	0.0530	0.0917	0.331	0.659
1.10	0.000	1.000	97.9	0.0236	0.213	0.0711	0.123	0.445	0.884
1.42	0.000	1.000	75.9	0.0304	0.275	0.0917	0.159	0.574	1.14
1.75	0.000	1.000	61.6	0.0375	0.339	0.113	0.196	0.707	1.41
2.14	0.012	0.988	50.3	0.0459	0.415	0.138	0.239	0.865	1.72
2.58	0.055	0.945	41.8	0.0553	0.500	0.167	0.289	1.04	2.07
3.07	0.089	0.911	35.1	0.0658	0.595	0.198	0.343	1.24	2.47
3.61	0.116	0.884	29.8	0.0774	0.700	0.233	0.404	1.46	2.90
4.20	0.137	0.863	25.7	0.0900	0.814	0.271	0.470	1.70	3.38
4.84	0.155	0.845	22.3	0.104	0.938	0.313	0.542	1.96	3.89
5.53	0.170	0.830	19.5	0.119	1.07	0.357	0.619	2.23	4.44
6.28	0.183	0.817	17.2	0.135	1.22	0.406	0.703	2.54	5.05
7.05	0.195	0.805	15.3	0.151	1.37	0.455	0.789	2.85	5.67
7.89	0.209	0.791	13.7	0.169	1.53	0.510	0.883	3.19	6.34
8.80	0.225	0.775	12.2	0.189	1.71	0.568	0.985	3.56	7.07
9.74	0.245	0.755	11.1	0.209	1.89	0.629	1.09	3.94	7.83
10.8	0.273	0.727	9.98	0.231	2.09	0.698	1.21	4.36	8.68
11.9	0.308	0.692	9.07	0.255	2.30	0.767	1.33	4.81	9.56
13.4	0.346	0.654	8.05	0.287	2.59	0.865	1.50	5.42	10.8
15.3	0.388	0.612	7.06	0.327	2.96	0.986	1.71	6.18	12.3
17.6	0.432	0.568	6.14	0.376	3.40	1.13	1.96	7.11	14.1
20.4	0.478	0.522	5.29	0.436	3.94	1.31	2.28	8.24	16.4
23.6	0.528	0.472	4.56	0.506	4.58	1.53	2.64	9.54	19.0
26.5	0.581	0.419	4.06	0.568	5.14	1.71	2.97	10.7	21.3
31.3	0.636	0.364	3.44	0.671	6.07	2.02	3.51	12.6	25.2
36.7	0.691	0.309	2.93	0.787	7.12	2.37	4.11	14.8	29.5
42.2	0.745	0.255	2.55	0.905	8.18	2.73	4.72	17.1	33.9
48.2	0.795	0.205	2.24	1.03	9.34	3.11	5.39	19.5	38.7
54.7	0.838	0.162	1.97	1.17	10.6	3.53	6.12	22.1	44.0
62.5	0.873	0.127	1.73	1.34	12.1	4.03	6.99	25.3	50.2
70.5	0.895	0.105	1.53	1.51	13.7	4.56	7.89	28.5	56.7
79.4	0.909	0.091	1.36	1.70	15.4	5.13	8.88	32.1	63.8

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**1m**	un-	Host Plug	
Depth, feet:	4725.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	322.	-
Swanson Permeability, md:		436.	-	-
Porosity, fraction:		0.323	0.316	-
maximum Sb/Pc, fraction:		1.05	-	-
R35, microns:		7.96	-	-
R50 (median pore throat radius):		4.97	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
89.6	0.921	0.079	1.20	1.92	17.4	5.79	10.0	36.2	72.0
102	0.930	0.070	1.05	2.19	19.8	6.61	11.5	41.2	82.0
115	0.938	0.062	0.935	2.47	22.3	7.45	12.9	46.5	92.4
131	0.946	0.054	0.825	2.80	25.3	8.44	14.6	52.9	105
146	0.954	0.046	0.736	3.14	28.4	9.46	16.4	59.0	117
167	0.960	0.040	0.644	3.58	32.4	10.8	18.7	67.5	134
189	0.966	0.034	0.571	4.05	36.6	12.2	21.1	76.4	152
214	0.971	0.029	0.504	4.58	41.4	13.8	23.9	86.5	172
241	0.975	0.025	0.448	5.16	46.6	15.5	26.9	97.4	194
275	0.980	0.020	0.392	5.90	53.3	17.8	30.8	111	221
311	0.983	0.017	0.347	6.66	60.2	20.1	34.8	126	250
352	0.986	0.014	0.306	7.53	68.1	22.7	39.3	142	283
399	0.988	0.012	0.270	8.54	77.3	25.8	44.6	161	321
450	0.989	0.011	0.239	9.64	87.2	29.1	50.3	182	362
508	0.990	0.010	0.212	10.9	98.5	32.8	56.8	205	408
578	0.992	0.008	0.186	12.4	112	37.3	64.7	234	465
655	0.993	0.007	0.165	14.0	127	42.3	73.2	265	526
734	0.994	0.006	0.147	15.7	142	47.4	82.1	297	590
830	0.995	0.005	0.130	17.8	161	53.6	92.9	335	667
943	0.995	0.005	0.114	20.2	183	60.9	106	381	758
1080	0.996	0.004	0.0998	23.1	209	69.8	121	436	868
1220	0.997	0.003	0.0885	26.1	236	78.6	136	493	981
1370	0.997	0.003	0.0787	29.3	265	88.4	153	554	1100
1540	0.998	0.002	0.0700	33.0	298	99.4	172	622	1240
1750	0.999	0.001	0.0615	37.5	339	113	196	707	1410
1980	0.999	0.001	0.0545	42.4	383	128	221	800	1590
2220	0.999	0.001	0.0486	47.5	430	143	248	897	1780
2510	1.000	0.000	0.0429	53.8	486	162	281	1010	2020
2830	1.000	0.000	0.0381	60.6	548	183	316	1140	2270
3220	1.000	0.000	0.0335	69.0	624	208	360	1300	2590
3660	1.000	0.000	0.0294	78.4	709	236	409	1480	2940
4150	1.000	0.000	0.0260	88.9	804	268	464	1680	3340

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

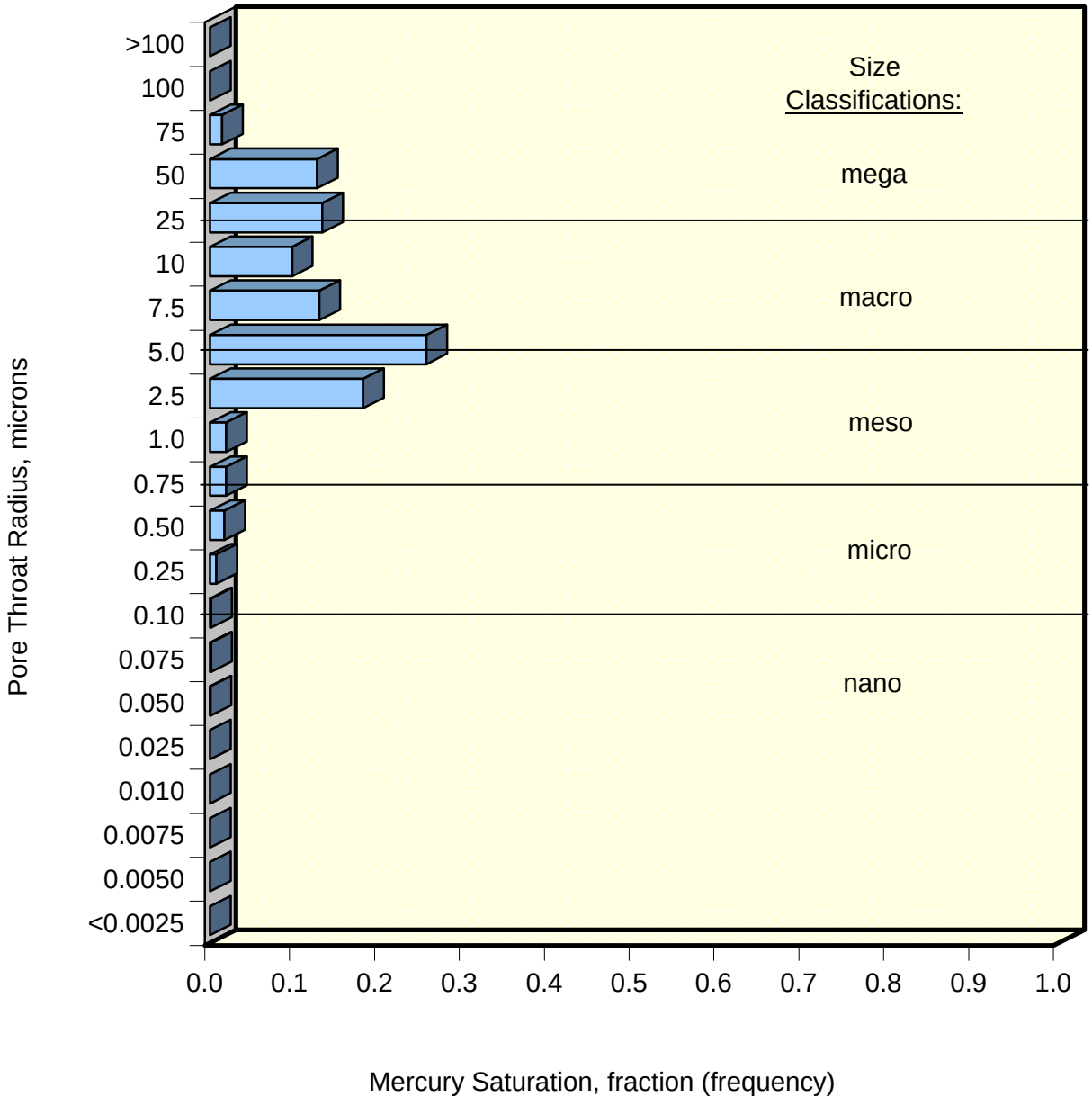
Sample:	**1m**	un-	Host Plug	
Depth, feet:	4725.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	322.	-
Swanson Permeability, md:		436.	-	-
Porosity, fraction:		0.323	0.316	-
maximum Sb/Pc, fraction:		1.05	-	-
R35, microns:		7.96	-	-
R50 (median pore throat radius):		4.97	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
4700	1.000	0.000	0.0229	101	910	303	525	1900	3780
5300	1.000	0.000	0.0203	114	1030	342	593	2140	4260
5970	1.000	0.000	0.0181	128	1160	385	668	2410	4800
6750	1.000	0.000	0.0160	145	1310	436	755	2730	5430
7650	1.000	0.000	0.0141	164	1480	494	855	3090	6150
8650	1.000	0.000	0.0125	185	1680	559	967	3500	6950
9790	1.000	0.000	0.0110	210	1900	632	1090	3960	7870
11000	1.000	0.000	0.00976	237	2140	713	1230	4450	8840
12500	1.000	0.000	0.00862	268	2420	807	1400	5050	10000
14100	1.000	0.000	0.00763	303	2740	913	1580	5700	11300
16000	1.000	0.000	0.00674	342	3100	1030	1790	6470	12900
18100	1.000	0.000	0.00596	387	3500	1170	2020	7310	14500
20400	1.000	0.000	0.00527	438	3960	1320	2290	8240	16400
23100	1.000	0.000	0.00466	495	4480	1490	2590	9340	18600
26200	1.000	0.000	0.00412	561	5070	1690	2930	10600	21100
29600	1.000	0.000	0.00364	634	5730	1910	3310	12000	23800
33500	1.000	0.000	0.00322	718	6490	2160	3750	13500	26900
37800	1.000	0.000	0.00285	811	7330	2440	4230	15300	30400
43000	1.000	0.000	0.00251	922	8330	2780	4810	17400	34600
48400	1.000	0.000	0.00223	1040	9380	3130	5420	19600	38900
55000	1.000	0.000	0.00196	1180	10700	3550	6150	22200	44200

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample: 1m	un-	Host Plug	
Depth, feet: 4725.80	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	322.	-
Swanson Permeability, md:	436.	-	-
Porosity, fraction:	0.323	0.316	-
maximum Sb/Pc, fraction:	1.05	-	-
R35, microns:	7.96	-	-
R50 (median pore throat radius):	4.97	-	-

PORE THROAT SIZE HISTOGRAM

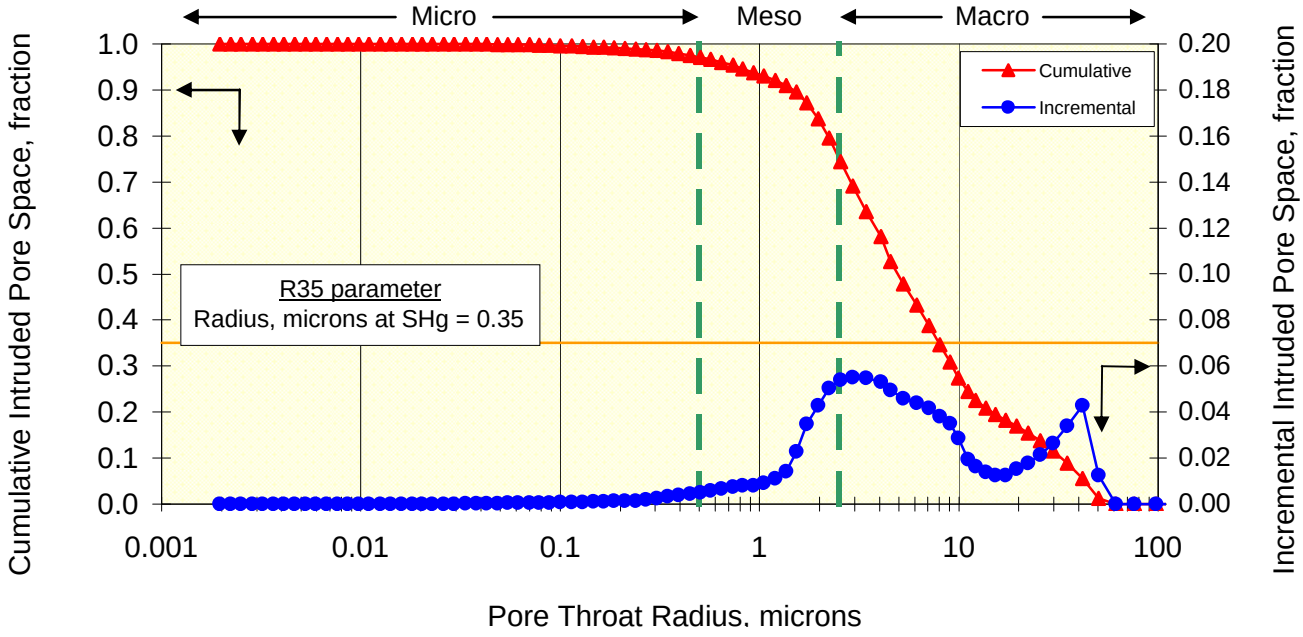


Core Laboratories

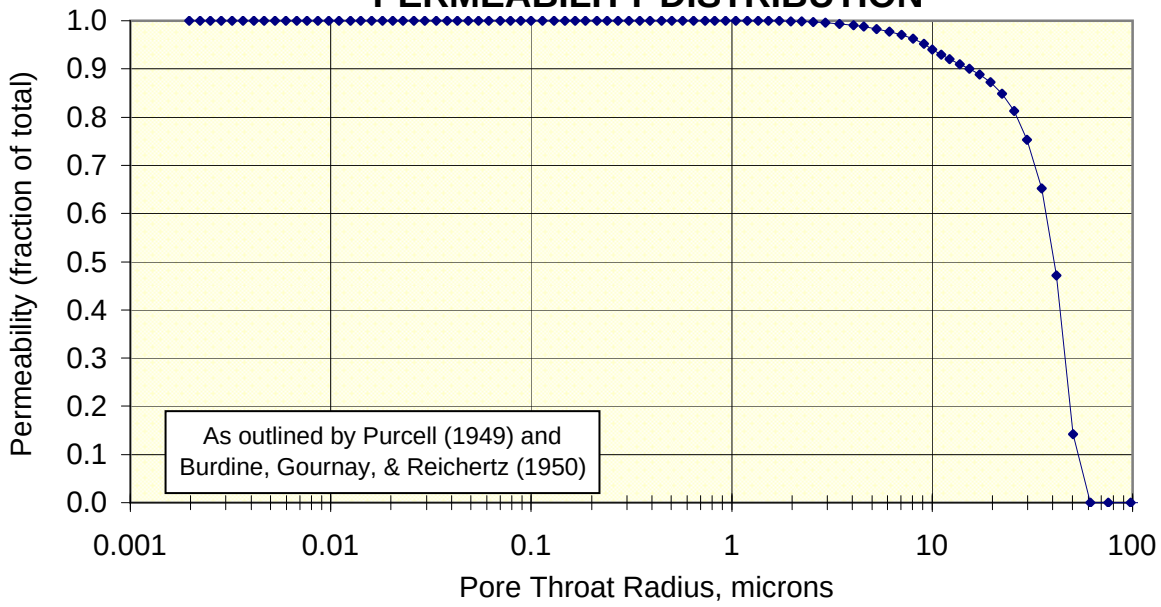
Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**1m**	un-	Host Plug	
Depth, feet:	4725.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	322.	-
Swanson Permeability, md:		436.	-	-
Porosity, fraction:		0.323	0.316	-
maximum Sb/Pc, fraction:		1.05	-	-
R35, microns:		7.96	-	-
R50 (median pore throat radius):		4.97	-	-

PORE THROAT RADIUS DISTRIBUTION



PERMEABILITY DISTRIBUTION

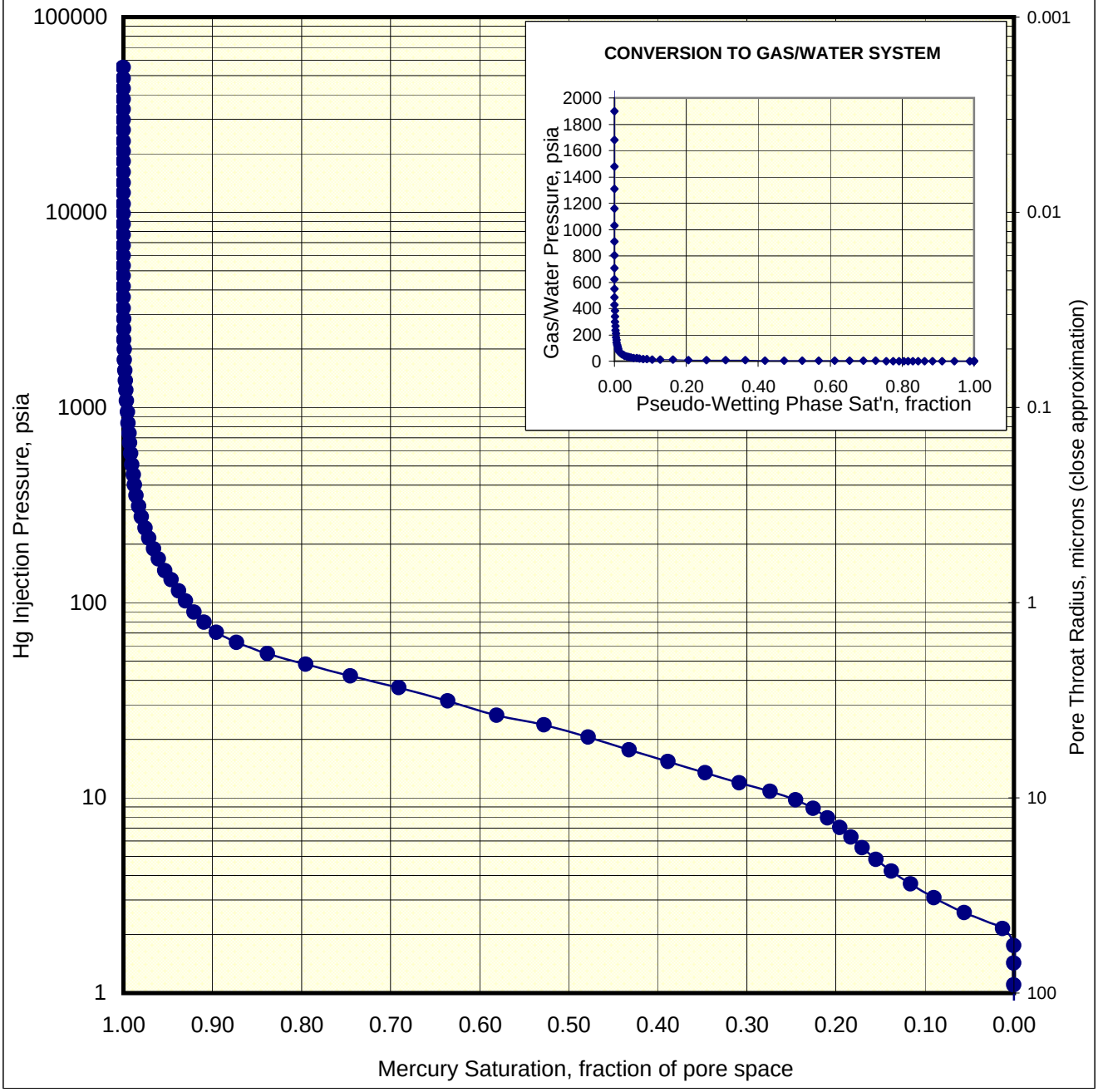


Core Laboratories

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**1m**	un-	Host Plug	
Depth, feet:	4725.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	322.	-
Swanson Permeability, md:		436.	-	-
Porosity, fraction:		0.323	0.316	-
maximum Sb/Pc, fraction:		1.05	-	-
R35, microns:		7.96	-	-
R50 (median pore throat radius):		4.97	-	-

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**2Am**	un-	Host Plug	
Depth (Feet):	4756.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	2380.	-
Swanson Permeability, md:		1200.	-	-
Porosity, fraction:		0.344	0.368	-
maximum Sb/Pc, fraction:		1.91	-	-
R35, microns:		16.6	-	-
R50 (median pore throat radius):		11.4	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
0.83	0.000	1.000	130	0.0286	0.161	0.0536	0.0929	0.335	0.667
1.10	0.000	1.000	97.9	0.0379	0.213	0.0711	0.123	0.445	0.884
1.41	0.000	1.000	76.4	0.0485	0.273	0.0911	0.158	0.570	1.13
1.75	0.000	1.000	61.6	0.0602	0.339	0.113	0.196	0.707	1.41
2.13	0.000	1.000	50.6	0.0733	0.413	0.138	0.238	0.861	1.71
2.57	0.000	1.000	41.9	0.0885	0.498	0.166	0.288	1.04	2.07
3.05	0.000	1.000	35.3	0.105	0.591	0.197	0.341	1.23	2.45
3.58	0.000	1.000	30.1	0.123	0.694	0.231	0.401	1.45	2.88
4.18	0.023	0.977	25.8	0.144	0.810	0.270	0.468	1.69	3.36
4.82	0.080	0.920	22.4	0.166	0.934	0.311	0.539	1.95	3.87
5.49	0.220	0.780	19.6	0.189	1.06	0.355	0.614	2.22	4.41
6.24	0.325	0.675	17.3	0.215	1.21	0.403	0.698	2.52	5.02
7.05	0.392	0.608	15.3	0.243	1.37	0.455	0.789	2.85	5.67
7.88	0.437	0.563	13.7	0.271	1.53	0.509	0.882	3.18	6.33
8.80	0.475	0.525	12.2	0.303	1.71	0.568	0.985	3.56	7.07
9.73	0.510	0.490	11.1	0.335	1.89	0.629	1.09	3.93	7.82
10.8	0.540	0.460	9.98	0.372	2.09	0.698	1.21	4.36	8.68
11.9	0.568	0.432	9.08	0.409	2.30	0.767	1.33	4.81	9.56
13.4	0.594	0.406	8.06	0.460	2.59	0.864	1.50	5.42	10.8
15.3	0.616	0.384	7.05	0.526	2.96	0.987	1.71	6.18	12.3
17.6	0.636	0.364	6.14	0.604	3.40	1.13	1.96	7.11	14.1
20.5	0.654	0.346	5.27	0.704	3.96	1.32	2.29	8.28	16.5
23.6	0.672	0.328	4.56	0.814	4.58	1.53	2.64	9.54	19.0
25.6	0.689	0.311	4.21	0.882	4.96	1.65	2.87	10.3	20.6
31.4	0.705	0.295	3.44	1.08	6.08	2.03	3.51	12.7	25.2
36.6	0.720	0.280	2.95	1.26	7.09	2.36	4.09	14.8	29.4
42.1	0.735	0.265	2.56	1.45	8.17	2.72	4.71	17.0	33.8
48.5	0.750	0.250	2.22	1.67	9.39	3.13	5.42	19.6	39.0
55.2	0.765	0.235	1.95	1.90	10.7	3.57	6.18	22.3	44.4
61.9	0.780	0.220	1.74	2.13	12.0	4.00	6.92	25.0	49.8
70.5	0.794	0.206	1.53	2.43	13.7	4.55	7.88	28.5	56.7
79.6	0.808	0.192	1.35	2.74	15.4	5.14	8.90	32.2	64.0

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**2Am**	un-	Host Plug	
Depth (Feet):	4756.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	2380.	-
Swanson Permeability, md:		1200.	-	-
Porosity, fraction:		0.344	0.368	-
maximum Sb/Pc, fraction:		1.91	-	-
R35, microns:		16.6	-	-
R50 (median pore throat radius):		11.4	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
89.8	0.821	0.179	1.20	3.09	17.4	5.80	10.0	36.3	72.2
102	0.833	0.167	1.06	3.51	19.8	6.59	11.4	41.2	82.0
115	0.844	0.156	0.933	3.97	22.4	7.46	12.9	46.5	92.4
131	0.853	0.147	0.821	4.52	25.4	8.47	14.7	52.9	105
147	0.862	0.138	0.735	5.05	28.4	9.47	16.4	59.4	118
168	0.870	0.130	0.642	5.78	32.5	10.8	18.8	67.9	135
190	0.878	0.122	0.566	6.55	36.9	12.3	21.3	76.8	153
213	0.884	0.116	0.505	7.34	41.3	13.8	23.9	86.1	171
241	0.890	0.110	0.447	8.29	46.7	15.6	27.0	97.4	194
275	0.896	0.104	0.392	9.46	53.3	17.8	30.7	111	221
312	0.902	0.098	0.346	10.7	60.4	20.1	34.9	126	251
352	0.907	0.093	0.306	12.1	68.2	22.7	39.4	142	283
399	0.911	0.089	0.270	13.7	77.3	25.8	44.6	161	321
449	0.916	0.084	0.240	15.5	87.0	29.0	50.2	181	361
509	0.920	0.080	0.212	17.5	98.5	32.8	56.9	206	409
579	0.924	0.076	0.186	19.9	112	37.4	64.8	234	465
654	0.928	0.072	0.165	22.5	127	42.2	73.1	264	526
733	0.931	0.069	0.147	25.2	142	47.3	82.0	296	589
829	0.935	0.065	0.130	28.5	161	53.5	92.7	335	666
943	0.939	0.061	0.114	32.5	183	60.9	106	381	758
1080	0.942	0.058	0.0998	37.1	209	69.7	121	436	868
1220	0.945	0.055	0.0884	42.0	236	78.7	136	493	981
1370	0.948	0.052	0.0787	47.1	265	88.5	153	554	1100
1540	0.951	0.049	0.0700	53.0	298	99.4	172	622	1240
1750	0.953	0.047	0.0616	60.2	339	113	196	707	1410
1980	0.956	0.044	0.0545	68.1	383	128	221	800	1590
2220	0.958	0.042	0.0486	76.4	430	143	248	897	1780
2510	0.961	0.039	0.0430	86.4	486	162	281	1010	2020
2830	0.963	0.037	0.0381	97.4	548	183	316	1140	2270
3220	0.966	0.034	0.0335	111	624	208	360	1300	2590
3660	0.968	0.032	0.0295	126	709	236	409	1480	2940
4150	0.971	0.029	0.0260	143	804	268	464	1680	3340

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

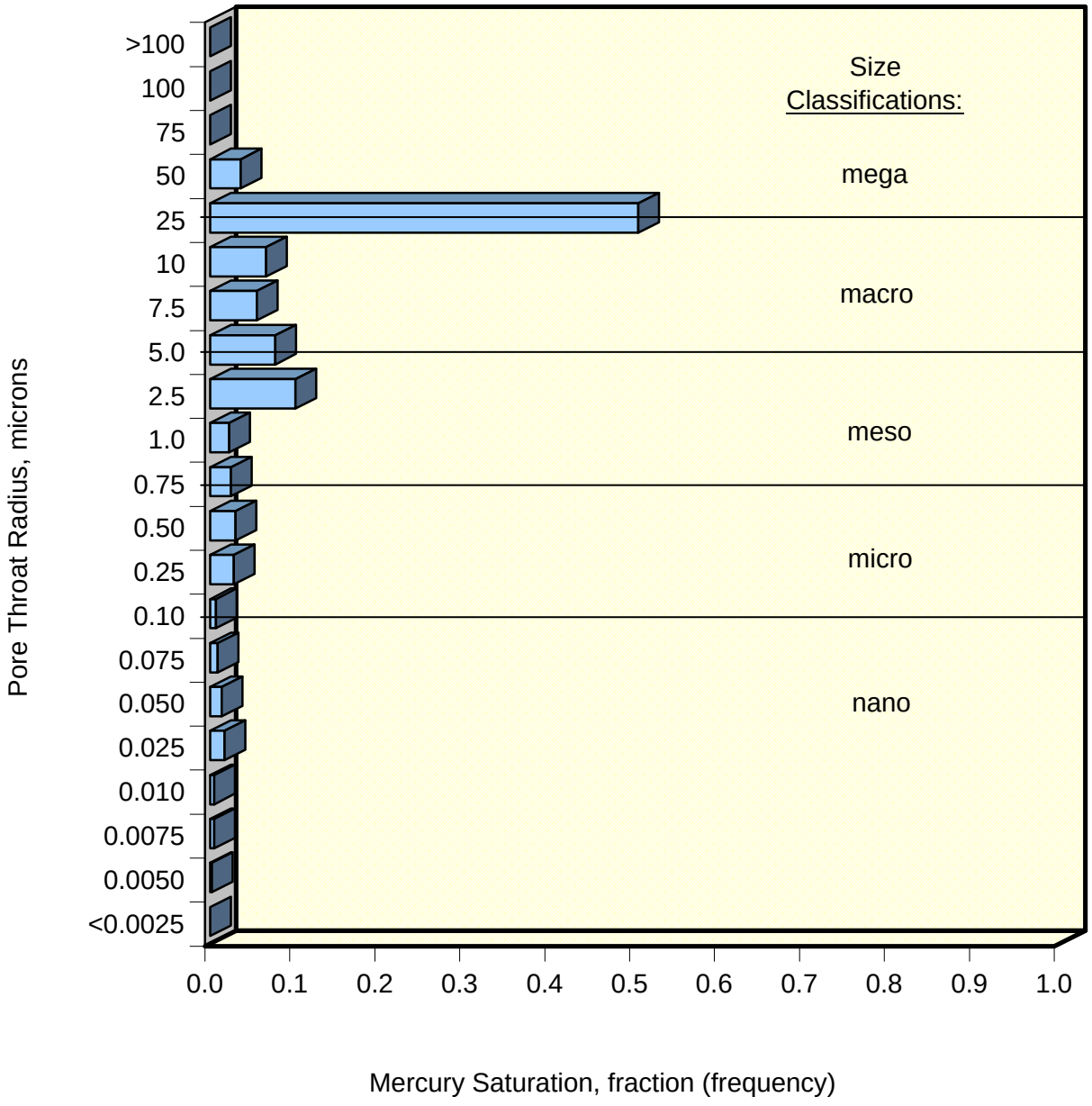
Sample:	**2Am**	un-	Host Plug	
Depth (Feet):	4756.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	2380.	-
Swanson Permeability, md:		1200.	-	-
Porosity, fraction:		0.344	0.368	-
maximum Sb/Pc, fraction:		1.91	-	-
R35, microns:		16.6	-	-
R50 (median pore throat radius):		11.4	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
4700	0.973	0.027	0.0229	162	910	303	526	1900	3780
5300	0.975	0.025	0.0203	182	1030	342	593	2140	4260
5970	0.978	0.022	0.0181	205	1160	385	667	2410	4800
6750	0.980	0.020	0.0160	232	1310	436	755	2730	5430
7650	0.983	0.017	0.0141	263	1480	494	855	3090	6150
8650	0.985	0.015	0.0125	298	1680	558	967	3500	6950
9790	0.987	0.013	0.0110	337	1900	632	1090	3960	7870
11000	0.989	0.011	0.00976	380	2140	713	1230	4450	8840
12500	0.991	0.009	0.00862	430	2420	807	1400	5050	10000
14100	0.993	0.007	0.00763	486	2740	912	1580	5700	11300
16000	0.995	0.005	0.00674	550	3100	1030	1790	6470	12900
18100	0.996	0.004	0.00596	622	3500	1170	2020	7310	14500
20400	0.998	0.002	0.00527	703	3960	1320	2290	8240	16400
23100	0.999	0.001	0.00466	796	4480	1490	2590	9340	18600
26200	0.999	0.001	0.00412	900	5070	1690	2930	10600	21100
29600	1.000	0.000	0.00364	1020	5730	1910	3310	12000	23800
33500	1.000	0.000	0.00322	1150	6490	2160	3750	13500	26900
37800	1.000	0.000	0.00285	1300	7330	2440	4230	15300	30400
43000	1.000	0.000	0.00250	1480	8340	2780	4810	17400	34600
48400	1.000	0.000	0.00223	1670	9380	3130	5410	19600	38900
55000	1.000	0.000	0.00196	1890	10700	3550	6150	22200	44200

Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample: **2Am**	un-	Host Plug	
Depth (Feet): 4756.80	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	2380.	-
Swanson Permeability, md:	1200.	-	-
Porosity, fraction:	0.344	0.368	-
maximum Sb/Pc, fraction:	1.91	-	-
R35, microns:	16.6	-	-
R50 (median pore throat radius):	11.4	-	-

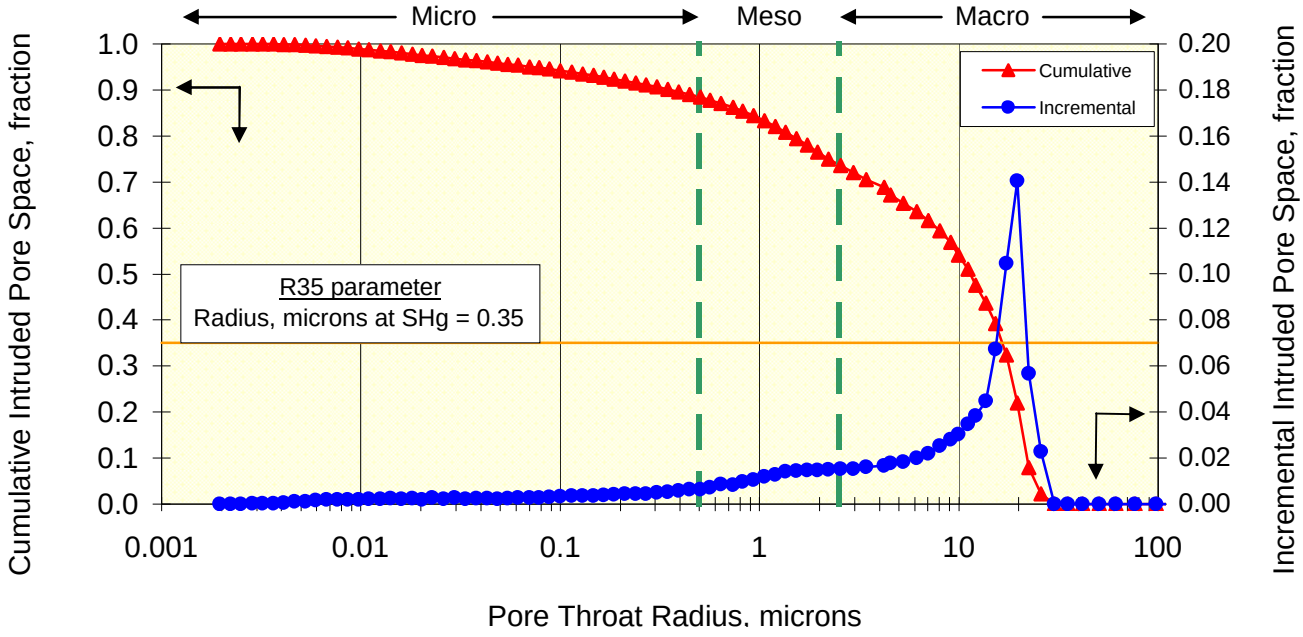
PORE THROAT SIZE HISTOGRAM



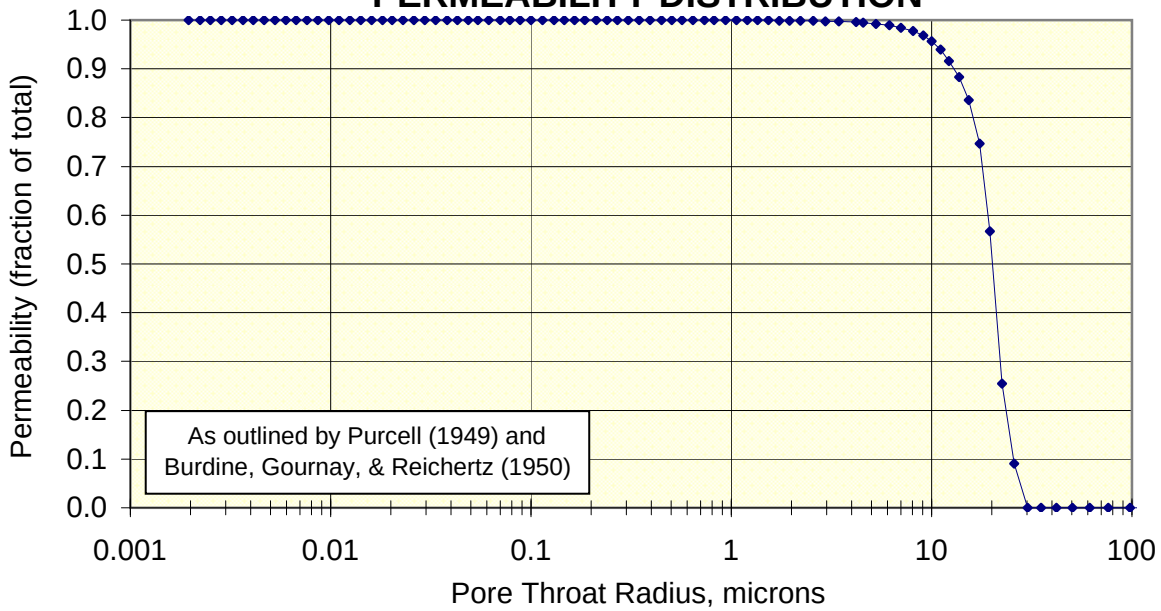
Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**2Am**	un-	Host Plug	
Depth (Feet):	4756.80	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	2380.	-
Swanson Permeability, md:		1200.	-	-
Porosity, fraction:		0.344	0.368	-
maximum Sb/Pc, fraction:		1.91	-	-
R35, microns:		16.6	-	-
R50 (median pore throat radius):		11.4	-	-

PORE THROAT RADIUS DISTRIBUTION



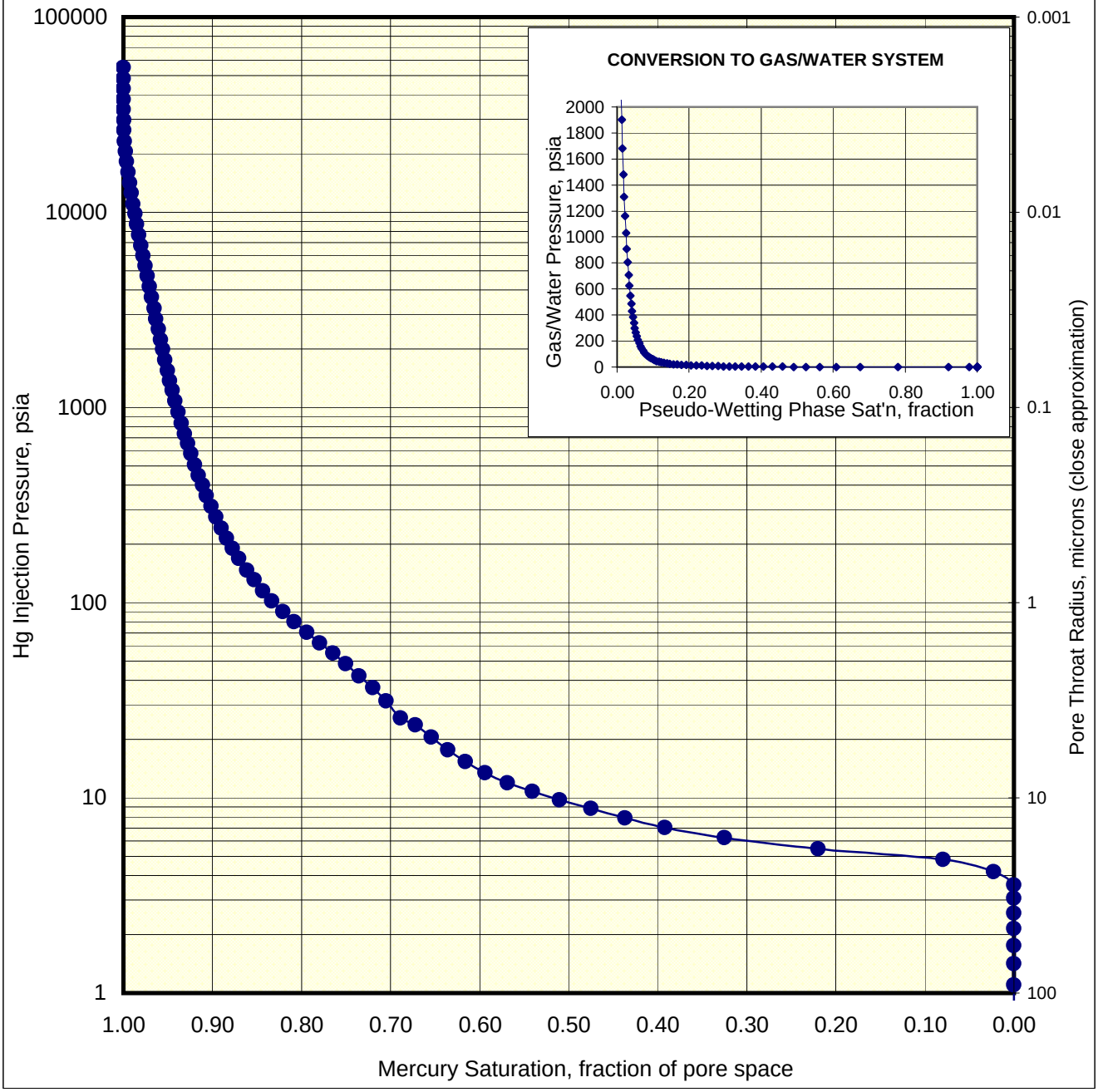
PERMEABILITY DISTRIBUTION



Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample: 2Am	un-	Host Plug	
Depth (Feet): 4756.80	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	2380.	-
Swanson Permeability, md:	1200.	-	-
Porosity, fraction:	0.344	0.368	-
maximum Sb/Pc, fraction:	1.91	-	-
R35, microns:	16.6	-	-
R50 (median pore throat radius):	11.4	-	-

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**3Am**	un-	Host Plug	
Depth (Feet):	4768.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	3760.	-
Swanson Permeability, md:		1050.	-	-
Porosity, fraction:		0.306	0.348	-
maximum Sb/Pc, fraction:		1.77	-	-
R35, microns:		16.8	-	-
R50 (median pore throat radius):		12.5	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
0.83	0.000	1.000	130	0.0284	0.161	0.0536	0.0929	0.335	0.667
1.10	0.000	1.000	97.9	0.0376	0.213	0.0711	0.123	0.445	0.884
1.41	0.000	1.000	76.4	0.0482	0.273	0.0911	0.158	0.570	1.13
1.75	0.000	1.000	61.6	0.0598	0.339	0.113	0.196	0.707	1.41
2.13	0.000	1.000	50.6	0.0728	0.413	0.138	0.238	0.861	1.71
2.57	0.000	1.000	41.9	0.0878	0.498	0.166	0.288	1.04	2.07
3.05	0.000	1.000	35.3	0.104	0.591	0.197	0.341	1.23	2.45
3.58	0.030	0.970	30.1	0.122	0.694	0.231	0.401	1.45	2.88
4.18	0.075	0.925	25.8	0.143	0.810	0.270	0.468	1.69	3.36
4.82	0.168	0.832	22.4	0.165	0.934	0.311	0.539	1.95	3.87
5.49	0.254	0.746	19.6	0.188	1.06	0.355	0.614	2.22	4.41
6.24	0.332	0.668	17.3	0.213	1.21	0.403	0.698	2.52	5.02
7.05	0.398	0.602	15.3	0.241	1.37	0.455	0.789	2.85	5.67
7.88	0.457	0.543	13.7	0.269	1.53	0.509	0.882	3.18	6.33
8.80	0.509	0.491	12.2	0.301	1.71	0.568	0.985	3.56	7.07
9.73	0.557	0.443	11.1	0.333	1.89	0.629	1.09	3.93	7.82
10.8	0.600	0.400	9.98	0.369	2.09	0.698	1.21	4.36	8.68
11.9	0.636	0.364	9.08	0.406	2.30	0.767	1.33	4.81	9.56
13.4	0.674	0.326	8.06	0.457	2.59	0.864	1.50	5.42	10.8
15.3	0.709	0.291	7.05	0.522	2.96	0.987	1.71	6.18	12.3
17.6	0.739	0.261	6.14	0.600	3.40	1.13	1.96	7.11	14.1
20.5	0.768	0.232	5.27	0.699	3.96	1.32	2.29	8.28	16.5
23.6	0.797	0.203	4.56	0.808	4.58	1.53	2.64	9.54	19.0
25.5	0.824	0.176	4.22	0.872	4.95	1.65	2.86	10.3	20.5
31.3	0.849	0.151	3.44	1.07	6.07	2.02	3.50	12.6	25.2
36.6	0.865	0.135	2.94	1.25	7.09	2.36	4.09	14.8	29.4
42.2	0.878	0.122	2.55	1.44	8.18	2.73	4.72	17.1	33.9
48.6	0.888	0.112	2.22	1.66	9.41	3.14	5.43	19.6	39.1
55.4	0.897	0.103	1.95	1.89	10.7	3.58	6.19	22.4	44.5
62.1	0.904	0.096	1.74	2.12	12.0	4.01	6.94	25.1	49.9
70.6	0.910	0.090	1.53	2.41	13.7	4.56	7.90	28.5	56.7
79.8	0.916	0.084	1.35	2.73	15.5	5.15	8.93	32.3	64.1

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**3Am**	un-	Host Plug	
Depth (Feet):	4768.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	3760.	-
Swanson Permeability, md:		1050.	-	-
Porosity, fraction:		0.306	0.348	-
maximum Sb/Pc, fraction:		1.77	-	-
R35, microns:		16.8	-	-
R50 (median pore throat radius):		12.5	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
90.1	0.921	0.079	1.20	3.08	17.5	5.82	10.1	36.4	72.4
102	0.927	0.073	1.05	3.50	19.8	6.61	11.4	41.2	82.0
116	0.931	0.069	0.931	3.96	22.4	7.48	12.9	46.9	93.2
131	0.936	0.064	0.820	4.49	25.5	8.49	14.7	52.9	105
147	0.939	0.061	0.734	5.02	28.5	9.49	16.4	59.4	118
168	0.943	0.057	0.640	5.75	32.6	10.9	18.8	67.9	135
191	0.946	0.054	0.565	6.52	37.0	12.3	21.3	77.2	154
214	0.949	0.051	0.505	7.30	41.4	13.8	23.9	86.5	172
241	0.952	0.048	0.446	8.25	46.8	15.6	27.0	97.4	194
275	0.955	0.045	0.392	9.40	53.3	17.8	30.8	111	221
312	0.958	0.042	0.345	10.7	60.5	20.2	34.9	126	251
353	0.960	0.040	0.306	12.0	68.3	22.8	39.4	143	284
399	0.962	0.038	0.270	13.6	77.4	25.8	44.7	161	321
450	0.965	0.035	0.240	15.4	87.1	29.0	50.3	182	362
509	0.967	0.033	0.212	17.4	98.6	32.9	56.9	206	409
579	0.969	0.031	0.186	19.8	112	37.4	64.8	234	465
654	0.971	0.029	0.165	22.4	127	42.3	73.2	264	526
733	0.973	0.027	0.147	25.1	142	47.4	82.1	296	589
829	0.975	0.025	0.130	28.3	161	53.6	92.8	335	666
944	0.977	0.023	0.114	32.3	183	61.0	106	382	759
1080	0.979	0.021	0.0998	36.9	209	69.7	121	436	868
1220	0.981	0.019	0.0884	41.7	236	78.8	136	493	981
1370	0.982	0.018	0.0787	46.8	265	88.5	153	554	1100
1540	0.983	0.017	0.0700	52.6	298	99.4	172	622	1240
1750	0.985	0.015	0.0616	59.8	339	113	196	707	1410
1980	0.986	0.014	0.0544	67.6	384	128	221	800	1590
2220	0.987	0.013	0.0486	75.8	430	143	248	897	1780
2510	0.988	0.012	0.0429	85.7	486	162	281	1010	2020
2830	0.990	0.010	0.0381	96.7	548	183	317	1140	2270
3220	0.991	0.009	0.0335	110	624	208	360	1300	2590
3660	0.992	0.008	0.0294	125	709	236	409	1480	2940
4150	0.993	0.007	0.0260	142	804	268	464	1680	3340

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

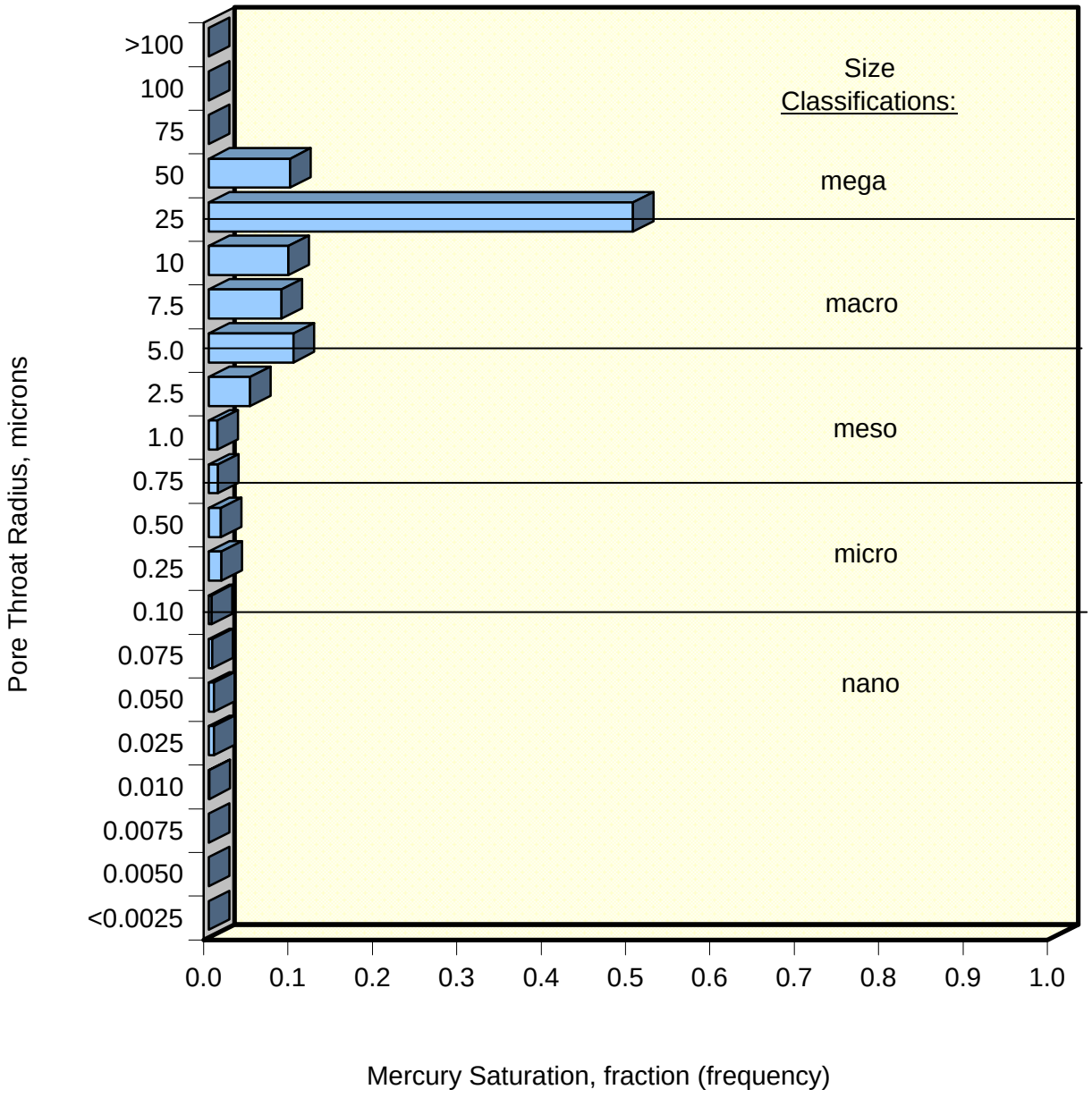
Sample:	**3Am**	un-	Host Plug	
Depth (Feet):	4768.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	3760.	-
Swanson Permeability, md:		1050.	-	-
Porosity, fraction:		0.306	0.348	-
maximum Sb/Pc, fraction:		1.77	-	-
R35, microns:		16.8	-	-
R50 (median pore throat radius):		12.5	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
4700	0.994	0.006	0.0229	161	910	303	526	1900	3780
5300	0.995	0.005	0.0203	181	1030	342	593	2140	4260
5970	0.996	0.004	0.0181	204	1160	385	667	2410	4800
6750	0.997	0.003	0.0160	231	1310	436	755	2730	5430
7650	0.997	0.003	0.0141	261	1480	494	856	3090	6150
8650	0.998	0.002	0.0125	295	1680	559	967	3500	6950
9790	0.999	0.001	0.0110	334	1900	632	1090	3960	7870
11000	0.999	0.001	0.00976	377	2140	713	1230	4450	8840
12500	0.999	0.001	0.00862	427	2420	807	1400	5050	10000
14100	1.000	0.000	0.00763	483	2740	912	1580	5700	11300
16000	1.000	0.000	0.00674	546	3100	1030	1790	6470	12900
18100	1.000	0.000	0.00596	618	3500	1170	2020	7310	14500
20400	1.000	0.000	0.00527	698	3960	1320	2290	8240	16400
23100	1.000	0.000	0.00466	790	4480	1490	2590	9340	18600
26200	1.000	0.000	0.00412	894	5070	1690	2930	10600	21100
29600	1.000	0.000	0.00364	1010	5730	1910	3310	12000	23800
33500	1.000	0.000	0.00322	1140	6490	2160	3750	13500	26900
37800	1.000	0.000	0.00285	1290	7330	2440	4230	15300	30400
43000	1.000	0.000	0.00250	1470	8340	2780	4810	17400	34600
48400	1.000	0.000	0.00223	1650	9380	3130	5410	19600	38900
55000	1.000	0.000	0.00196	1880	10700	3550	6150	22200	44200

Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample: **3Am**	un-	Host Plug	
Depth (Feet): 4768.30	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	3760.	-
Swanson Permeability, md:	1050.	-	-
Porosity, fraction:	0.306	0.348	-
maximum Sb/Pc, fraction:	1.77	-	-
R35, microns:	16.8	-	-
R50 (median pore throat radius):	12.5	-	-

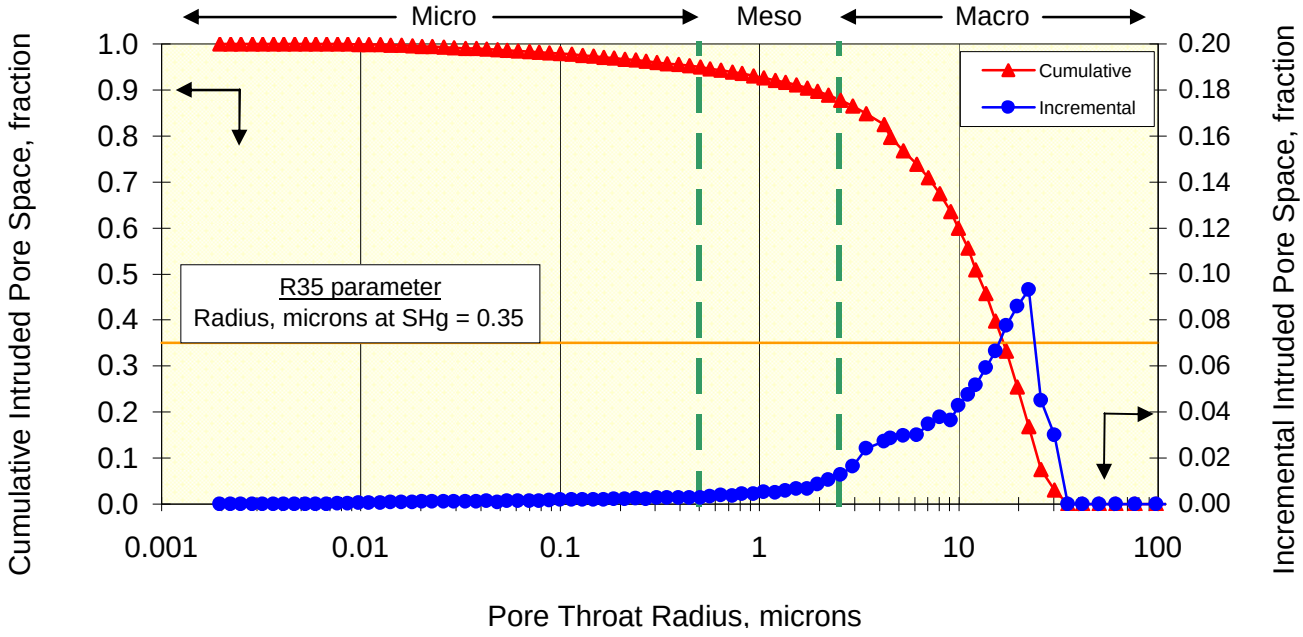
PORE THROAT SIZE HISTOGRAM



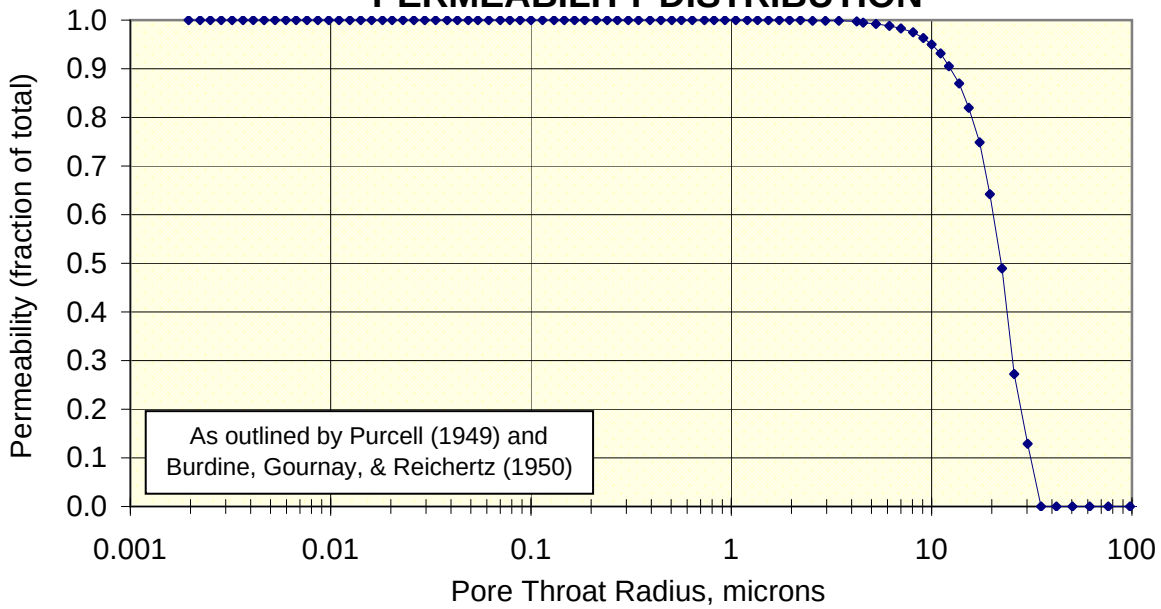
Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**3Am**	un-	Host Plug	
Depth (Feet):	4768.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	3760.	-
Swanson Permeability, md:		1050.	-	-
Porosity, fraction:		0.306	0.348	-
maximum Sb/Pc, fraction:		1.77	-	-
R35, microns:		16.8	-	-
R50 (median pore throat radius):		12.5	-	-

PORE THROAT RADIUS DISTRIBUTION



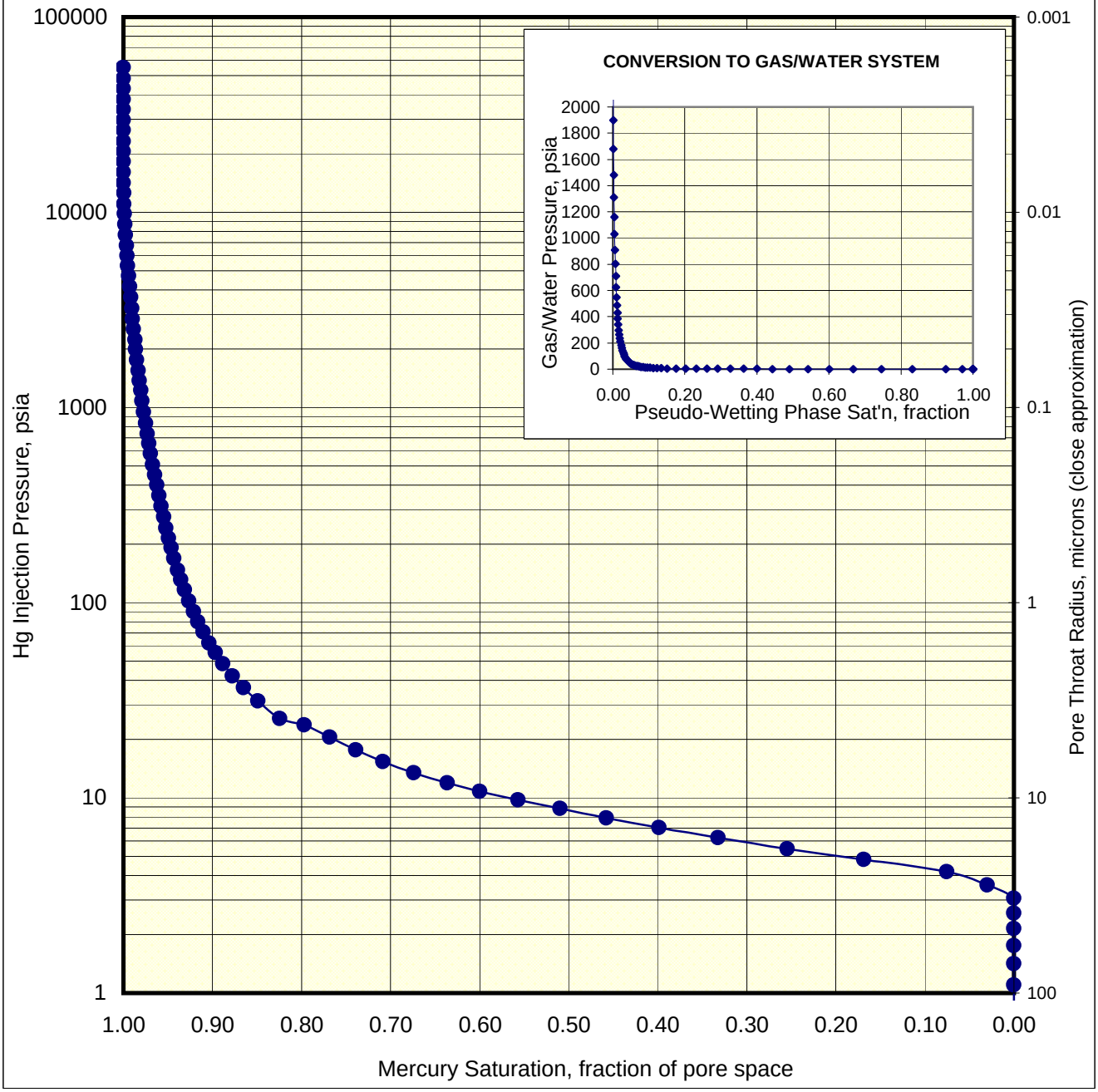
PERMEABILITY DISTRIBUTION



Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample: 3Am	un-	Host Plug	
Depth (Feet): 4768.30	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	3760.	-
Swanson Permeability, md:	1050.	-	-
Porosity, fraction:	0.306	0.348	-
maximum Sb/Pc, fraction:	1.77	-	-
R35, microns:	16.8	-	-
R50 (median pore throat radius):	12.5	-	-

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**4Am**	un-	Host Plug	
Depth (Feet):	4774.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	7000.	-
Swanson Permeability, md:		1100.	-	-
Porosity, fraction:		0.289	0.366	-
maximum Sb/Pc, fraction:		1.82	-	-
R35, microns:		17.7	-	-
R50 (median pore throat radius):		13.6	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
0.82	0.000	1.000	131	0.0295	0.159	0.0530	0.0917	0.331	0.659
1.09	0.000	1.000	98.8	0.0392	0.211	0.0704	0.122	0.441	0.876
1.40	0.000	1.000	77.0	0.0504	0.271	0.0904	0.157	0.566	1.13
1.74	0.000	1.000	61.9	0.0626	0.337	0.112	0.195	0.703	1.40
2.13	0.000	1.000	50.6	0.0767	0.413	0.138	0.238	0.861	1.71
2.57	0.000	1.000	41.9	0.0925	0.498	0.166	0.288	1.04	2.07
3.06	0.000	1.000	35.2	0.110	0.593	0.198	0.342	1.24	2.46
3.61	0.000	1.000	29.8	0.130	0.700	0.233	0.404	1.46	2.90
4.19	0.063	0.937	25.7	0.151	0.812	0.271	0.469	1.69	3.37
4.83	0.183	0.817	22.3	0.174	0.936	0.312	0.540	1.95	3.88
5.52	0.284	0.716	19.5	0.199	1.07	0.357	0.618	2.23	4.44
6.26	0.367	0.633	17.2	0.225	1.21	0.404	0.700	2.53	5.03
7.05	0.436	0.564	15.3	0.254	1.37	0.455	0.789	2.85	5.67
7.89	0.497	0.503	13.7	0.284	1.53	0.510	0.883	3.19	6.34
8.80	0.552	0.448	12.2	0.317	1.71	0.568	0.985	3.56	7.07
9.74	0.598	0.402	11.1	0.351	1.89	0.629	1.09	3.94	7.83
10.8	0.638	0.362	9.99	0.388	2.09	0.697	1.21	4.36	8.68
11.9	0.671	0.329	9.07	0.428	2.30	0.767	1.33	4.81	9.56
13.4	0.706	0.294	8.05	0.482	2.59	0.865	1.50	5.42	10.8
15.3	0.738	0.262	7.06	0.550	2.96	0.986	1.71	6.18	12.3
17.6	0.767	0.233	6.14	0.632	3.40	1.13	1.96	7.11	14.1
20.4	0.794	0.206	5.28	0.735	3.96	1.32	2.28	8.24	16.4
23.6	0.817	0.183	4.56	0.850	4.58	1.53	2.64	9.54	19.0
26.3	0.837	0.163	4.09	0.948	5.10	1.70	2.95	10.6	21.1
31.5	0.854	0.146	3.42	1.13	6.10	2.03	3.52	12.7	25.3
36.7	0.866	0.134	2.93	1.32	7.12	2.37	4.11	14.8	29.5
42.2	0.875	0.125	2.55	1.52	8.18	2.73	4.72	17.1	33.9
48.4	0.885	0.115	2.23	1.74	9.37	3.12	5.41	19.6	38.9
54.8	0.892	0.108	1.97	1.97	10.6	3.54	6.13	22.1	44.0
61.6	0.899	0.101	1.75	2.22	11.9	3.98	6.89	24.9	49.5
70.2	0.906	0.094	1.53	2.53	13.6	4.54	7.86	28.4	56.4
79.7	0.912	0.088	1.35	2.87	15.4	5.15	8.92	32.2	64.1

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**4Am**	un-	Host Plug	
Depth (Feet):	4774.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	7000.	-
Swanson Permeability, md:		1100.	-	-
Porosity, fraction:		0.289	0.366	-
maximum Sb/Pc, fraction:		1.82	-	-
R35, microns:		17.7	-	-
R50 (median pore throat radius):		13.6	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
89.9	0.918	0.082	1.20	3.24	17.4	5.81	10.1	36.3	72.3
102	0.923	0.077	1.06	3.66	19.7	6.57	11.4	41.2	82.0
116	0.928	0.072	0.929	4.17	22.5	7.49	13.0	46.9	93.2
131	0.932	0.068	0.821	4.72	25.4	8.48	14.7	52.9	105
147	0.936	0.064	0.734	5.29	28.5	9.49	16.4	59.4	118
167	0.940	0.060	0.644	6.02	32.4	10.8	18.7	67.5	134
189	0.943	0.057	0.569	6.81	36.7	12.2	21.2	76.4	152
213	0.946	0.054	0.506	7.66	41.2	13.7	23.8	86.1	171
241	0.949	0.051	0.448	8.66	46.6	15.5	26.9	97.4	194
275	0.952	0.048	0.392	9.88	53.2	17.7	30.7	111	221
313	0.954	0.046	0.345	11.2	60.6	20.2	35.0	126	252
353	0.957	0.043	0.306	12.7	68.3	22.8	39.4	143	284
399	0.960	0.040	0.270	14.4	77.4	25.8	44.7	161	321
449	0.962	0.038	0.240	16.2	87.1	29.0	50.3	181	361
509	0.965	0.035	0.212	18.3	98.7	32.9	57.0	206	409
580	0.967	0.033	0.186	20.9	112	37.4	64.8	234	466
653	0.970	0.030	0.165	23.5	127	42.2	73.1	264	525
734	0.972	0.028	0.147	26.4	142	47.4	82.1	297	590
830	0.974	0.026	0.130	29.9	161	53.6	92.8	335	667
944	0.976	0.024	0.114	34.0	183	61.0	106	382	759
1080	0.978	0.022	0.0998	38.8	209	69.7	121	436	868
1220	0.980	0.020	0.0885	43.8	236	78.6	136	493	981
1370	0.982	0.018	0.0787	49.3	265	88.4	153	554	1100
1540	0.983	0.017	0.0700	55.4	298	99.4	172	622	1240
1750	0.985	0.015	0.0616	62.9	339	113	196	707	1410
1980	0.987	0.013	0.0545	71.2	383	128	221	800	1590
2220	0.988	0.012	0.0486	79.8	430	143	248	897	1780
2510	0.990	0.010	0.0430	90.3	486	162	281	1010	2020
2830	0.992	0.008	0.0381	102	548	183	317	1140	2270
3220	0.993	0.007	0.0335	116	624	208	360	1300	2590
3660	0.995	0.005	0.0294	132	709	236	409	1480	2940
4150	0.997	0.003	0.0260	149	804	268	464	1680	3340

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

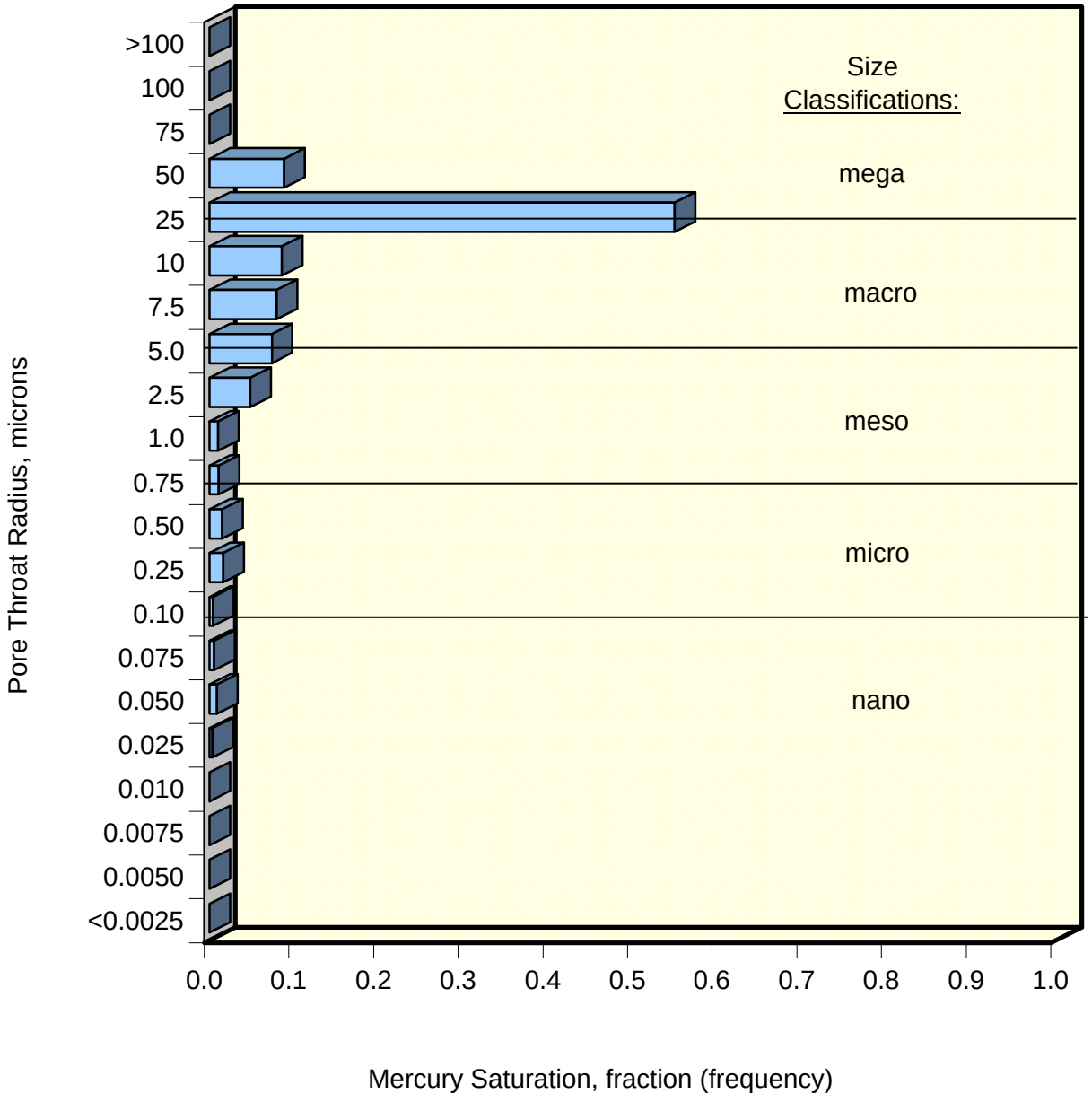
Sample:	**4Am**	un-	Host Plug	
Depth (Feet):	4774.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	7000.	-
Swanson Permeability, md:		1100.	-	-
Porosity, fraction:		0.289	0.366	-
maximum Sb/Pc, fraction:		1.82	-	-
R35, microns:		17.7	-	-
R50 (median pore throat radius):		13.6	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
4700	0.997	0.003	0.0229	169	910	303	526	1900	3780
5300	0.998	0.002	0.0203	191	1030	342	593	2140	4260
5970	0.999	0.001	0.0181	215	1160	385	667	2410	4800
6750	0.999	0.001	0.0160	243	1310	436	755	2730	5430
7650	0.999	0.001	0.0141	275	1480	494	856	3090	6150
8650	1.000	0.000	0.0125	311	1680	558	967	3500	6950
9790	1.000	0.000	0.0110	352	1900	632	1090	3960	7870
11000	1.000	0.000	0.00976	397	2140	713	1230	4450	8840
12500	1.000	0.000	0.00862	450	2420	807	1400	5050	10000
14100	1.000	0.000	0.00763	508	2740	913	1580	5700	11300
16000	1.000	0.000	0.00674	575	3100	1030	1790	6470	12900
18100	1.000	0.000	0.00596	650	3500	1170	2020	7310	14500
20400	1.000	0.000	0.00527	735	3960	1320	2290	8240	16400
23100	1.000	0.000	0.00466	832	4480	1490	2590	9340	18600
26200	1.000	0.000	0.00412	941	5070	1690	2930	10600	21100
29600	1.000	0.000	0.00364	1060	5730	1910	3310	12000	23800
33500	1.000	0.000	0.00322	1210	6490	2160	3750	13500	26900
37800	1.000	0.000	0.00285	1360	7330	2440	4230	15300	30400
43000	1.000	0.000	0.00251	1550	8330	2780	4810	17400	34600
48400	1.000	0.000	0.00223	1740	9380	3130	5410	19600	38900
55000	1.000	0.000	0.00196	1980	10700	3550	6150	22200	44200

Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample: 4Am	un-	Host Plug	
Depth (Feet): 4774.30	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	7000.	-
Swanson Permeability, md:	1100.	-	-
Porosity, fraction:	0.289	0.366	-
maximum Sb/Pc, fraction:	1.82	-	-
R35, microns:	17.7	-	-
R50 (median pore throat radius):	13.6	-	-

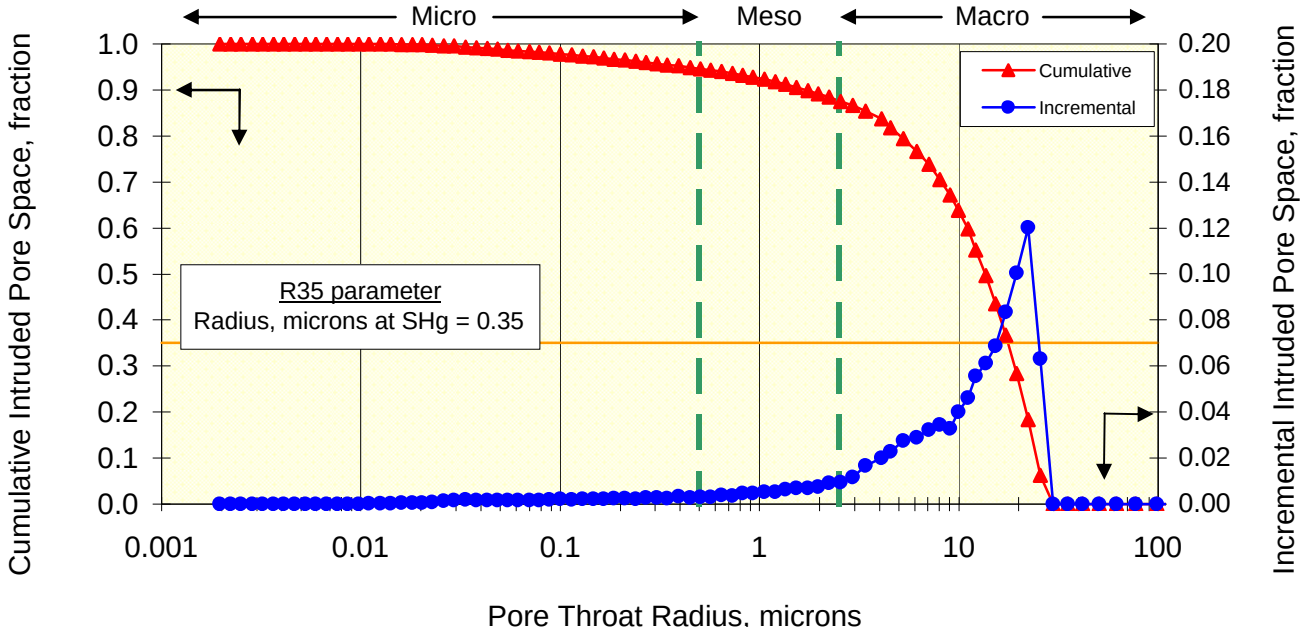
PORE THROAT SIZE HISTOGRAM



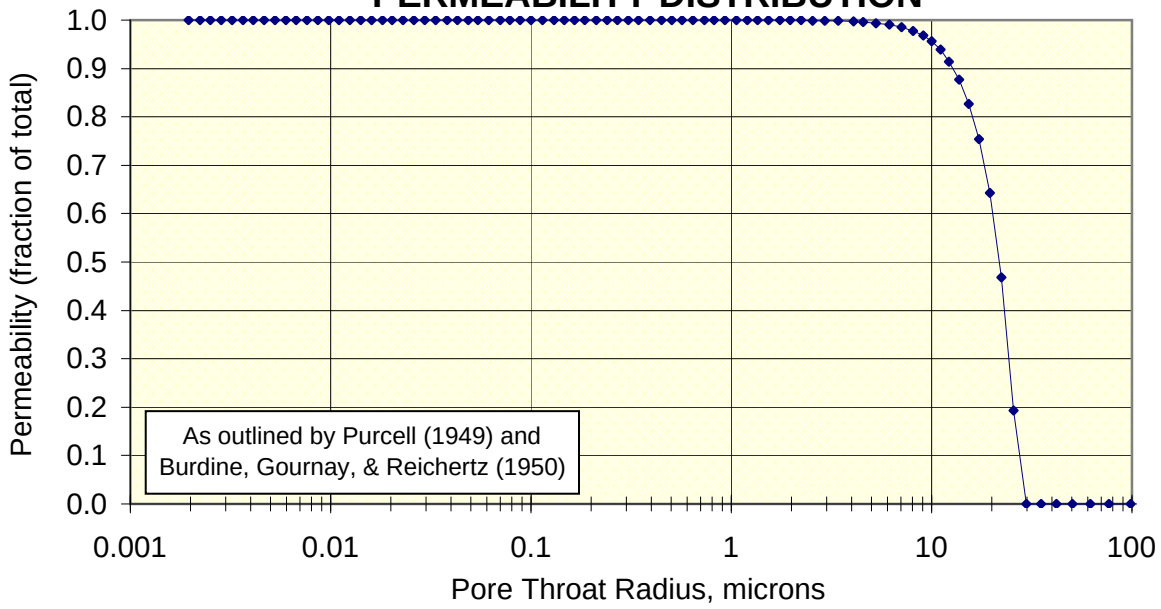
Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**4Am**	un-	Host Plug	
Depth (Feet):	4774.30	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	7000.	-
Swanson Permeability, md:		1100.	-	-
Porosity, fraction:		0.289	0.366	-
maximum Sb/Pc, fraction:		1.82	-	-
R35, microns:		17.7	-	-
R50 (median pore throat radius):		13.6	-	-

PORE THROAT RADIUS DISTRIBUTION



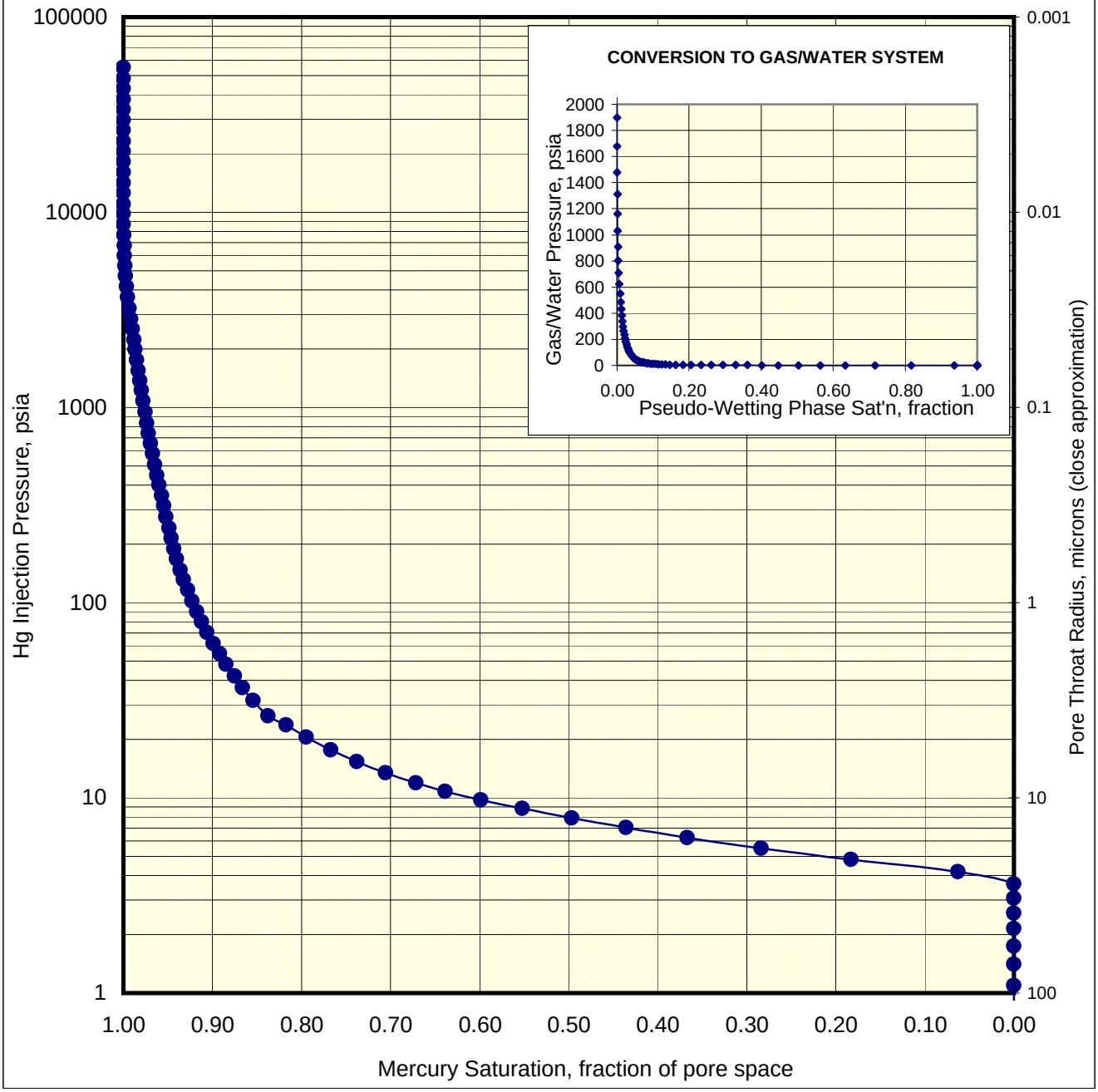
PERMEABILITY DISTRIBUTION



Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample: 4Am	un-	Host Plug	
Depth (Feet): 4774.30	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	7000.	-
Swanson Permeability, md:	1100.	-	-
Porosity, fraction:	0.289	0.366	-
maximum Sb/Pc, fraction:	1.82	-	-
R35, microns:	17.7	-	-
R50 (median pore throat radius):	13.6	-	-

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**5Am**	un-	Host Plug	
Depth (Feet):	4780.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	4160.	-
Swanson Permeability, md:		2080.	-	-
Porosity, fraction:		0.367	0.368	-
maximum Sb/Pc, fraction:		2.66	-	-
R35, microns:		20.5	-	-
R50 (median pore throat radius):		15.5	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
0.82	0.000	1.000	131	0.0360	0.159	0.0530	0.0917	0.331	0.659
1.09	0.000	1.000	98.8	0.0478	0.211	0.0704	0.122	0.441	0.876
1.40	0.000	1.000	77.0	0.0615	0.271	0.0904	0.157	0.566	1.13
1.74	0.000	1.000	61.9	0.0764	0.337	0.112	0.195	0.703	1.40
2.13	0.000	1.000	50.6	0.0935	0.413	0.138	0.238	0.861	1.71
2.57	0.015	0.985	41.9	0.113	0.498	0.166	0.288	1.04	2.07
3.06	0.034	0.966	35.2	0.134	0.593	0.198	0.342	1.24	2.46
3.61	0.063	0.937	29.8	0.158	0.700	0.233	0.404	1.46	2.90
4.19	0.156	0.844	25.7	0.184	0.812	0.271	0.469	1.69	3.37
4.83	0.289	0.711	22.3	0.212	0.936	0.312	0.540	1.95	3.88
5.52	0.383	0.617	19.5	0.242	1.07	0.357	0.618	2.23	4.44
6.26	0.453	0.547	17.2	0.275	1.21	0.404	0.700	2.53	5.03
7.05	0.506	0.494	15.3	0.309	1.37	0.455	0.789	2.85	5.67
7.89	0.548	0.452	13.7	0.346	1.53	0.510	0.883	3.19	6.34
8.80	0.583	0.417	12.2	0.386	1.71	0.568	0.985	3.56	7.07
9.74	0.610	0.390	11.1	0.428	1.89	0.629	1.09	3.94	7.83
10.8	0.634	0.366	9.99	0.474	2.09	0.697	1.21	4.36	8.68
11.9	0.653	0.347	9.07	0.521	2.30	0.767	1.33	4.81	9.56
13.4	0.674	0.326	8.05	0.588	2.59	0.865	1.50	5.42	10.8
15.3	0.693	0.307	7.06	0.670	2.96	0.986	1.71	6.18	12.3
17.6	0.712	0.288	6.14	0.771	3.40	1.13	1.96	7.11	14.1
20.4	0.733	0.267	5.28	0.896	3.96	1.32	2.28	8.24	16.4
23.6	0.751	0.249	4.56	1.04	4.58	1.53	2.64	9.54	19.0
26.2	0.769	0.231	4.11	1.15	5.08	1.69	2.93	10.6	21.1
31.3	0.784	0.216	3.44	1.38	6.07	2.02	3.51	12.6	25.2
36.6	0.798	0.202	2.95	1.60	7.08	2.36	4.09	14.8	29.4
42.0	0.814	0.186	2.57	1.84	8.14	2.71	4.70	17.0	33.8
48.1	0.828	0.172	2.24	2.11	9.33	3.11	5.38	19.4	38.7
54.6	0.840	0.160	1.97	2.40	10.6	3.53	6.11	22.1	43.9
61.3	0.851	0.149	1.76	2.69	11.9	3.96	6.86	24.8	49.3
69.9	0.862	0.138	1.54	3.07	13.6	4.52	7.83	28.2	56.2
79.4	0.872	0.128	1.36	3.48	15.4	5.13	8.88	32.1	63.8

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

Sample:	**5Am**	un-	Host Plug	
Depth (Feet):	4780.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	4160.	-
Swanson Permeability, md:		2080.	-	-
Porosity, fraction:		0.367	0.368	-
maximum Sb/Pc, fraction:		2.66	-	-
R35, microns:		20.5	-	-
R50 (median pore throat radius):		15.5	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
89.6	0.880	0.120	1.20	3.93	17.4	5.79	10.0	36.2	72.0
101	0.888	0.112	1.06	4.45	19.6	6.55	11.3	40.8	81.2
116	0.895	0.105	0.932	5.08	22.4	7.47	12.9	46.9	93.2
131	0.901	0.099	0.823	5.74	25.4	8.45	14.6	52.9	105
147	0.907	0.093	0.735	6.43	28.4	9.46	16.4	59.4	118
167	0.912	0.088	0.645	7.33	32.4	10.8	18.7	67.5	134
189	0.917	0.083	0.570	8.29	36.6	12.2	21.1	76.4	152
212	0.921	0.079	0.507	9.32	41.1	13.7	23.8	85.7	170
240	0.924	0.076	0.449	10.5	46.5	15.5	26.9	97.0	193
274	0.928	0.072	0.393	12.0	53.1	17.7	30.7	111	220
312	0.931	0.069	0.345	13.7	60.5	20.2	34.9	126	251
352	0.935	0.065	0.306	15.5	68.2	22.7	39.4	142	283
399	0.938	0.062	0.270	17.5	77.3	25.8	44.6	161	321
449	0.941	0.059	0.240	19.7	87.0	29.0	50.2	181	361
509	0.944	0.056	0.212	22.3	98.6	32.9	56.9	206	409
579	0.947	0.053	0.186	25.4	112	37.4	64.8	234	465
653	0.949	0.051	0.165	28.6	126	42.2	73.0	264	525
734	0.952	0.048	0.147	32.2	142	47.4	82.1	297	590
829	0.954	0.046	0.130	36.4	161	53.6	92.8	335	666
943	0.957	0.043	0.114	41.4	183	60.9	106	381	758
1080	0.959	0.041	0.0998	47.4	209	69.7	121	436	868
1220	0.962	0.038	0.0885	53.4	236	78.6	136	493	981
1370	0.964	0.036	0.0787	60.1	265	88.4	153	554	1100
1540	0.966	0.034	0.0700	67.5	298	99.4	172	622	1240
1750	0.968	0.032	0.0616	76.7	339	113	196	707	1410
1980	0.970	0.030	0.0545	86.8	383	128	221	800	1590
2220	0.972	0.028	0.0486	97.3	430	143	248	897	1780
2510	0.974	0.026	0.0429	110	486	162	281	1010	2020
2830	0.976	0.024	0.0381	124	548	183	316	1140	2270
3220	0.978	0.022	0.0335	141	624	208	360	1300	2590
3660	0.980	0.020	0.0294	161	709	236	409	1480	2940
4150	0.982	0.018	0.0260	182	804	268	464	1680	3340

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacenine 2-27
Field: King Island
Location: San Joaquin County, CA
File: HOU-130585
BAK-313024PG

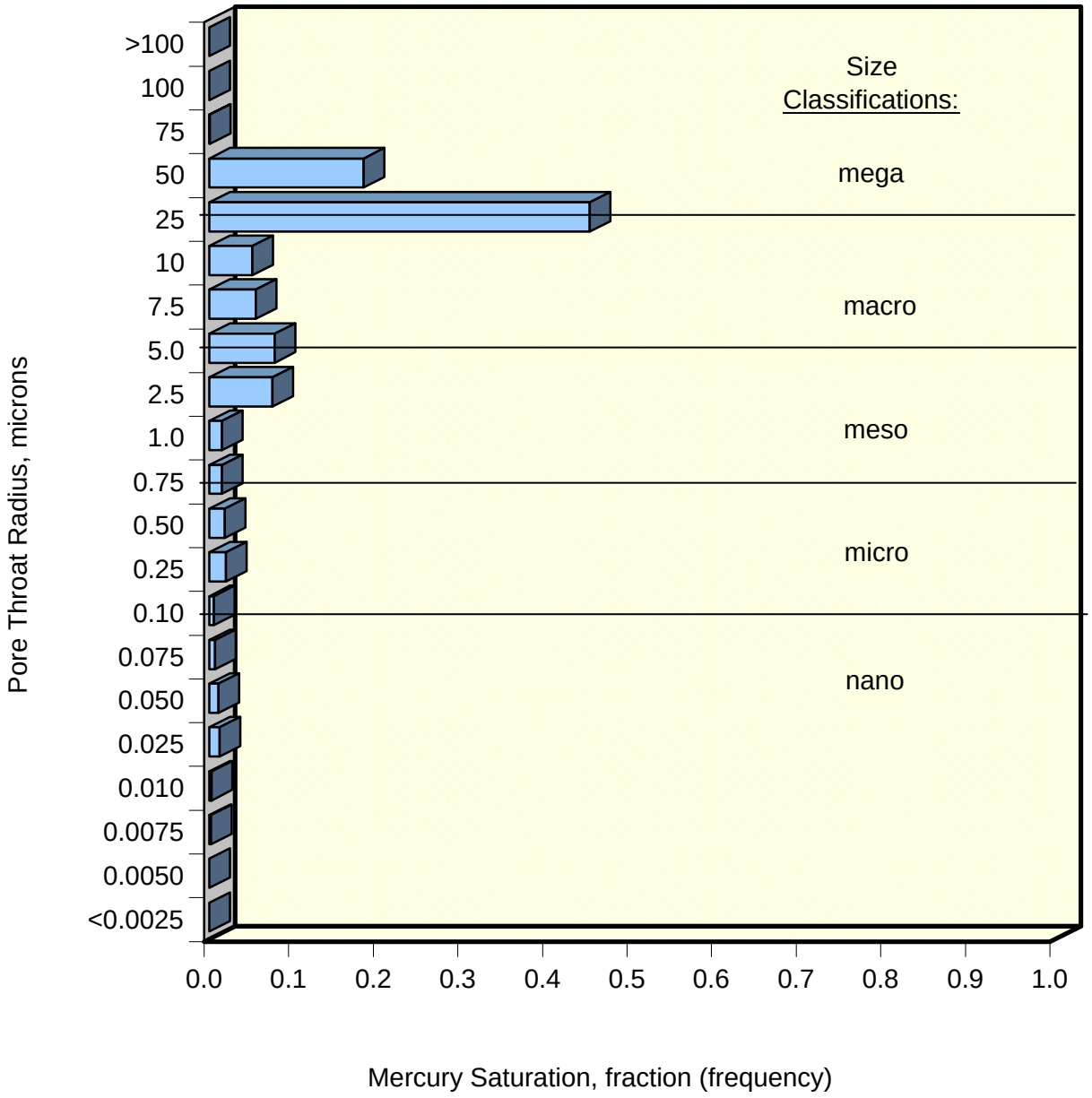
Sample:	**5Am**	un-	Host Plug	
Depth (Feet):	4780.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	4160.	-
Swanson Permeability, md:		2080.	-	-
Porosity, fraction:		0.367	0.368	-
maximum Sb/Pc, fraction:		2.66	-	-
R35, microns:		20.5	-	-
R50 (median pore throat radius):		15.5	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
4700	0.983	0.017	0.0229	206	910	303	526	1900	3780
5300	0.985	0.015	0.0203	232	1030	342	593	2140	4260
5960	0.986	0.014	0.0181	262	1160	385	667	2410	4790
6750	0.988	0.012	0.0160	296	1310	436	755	2730	5430
7650	0.990	0.010	0.0141	336	1480	494	855	3090	6150
8640	0.992	0.008	0.0125	379	1680	558	967	3490	6940
9790	0.993	0.007	0.0110	430	1900	632	1090	3960	7870
11000	0.995	0.005	0.00976	484	2140	713	1230	4450	8840
12500	0.996	0.004	0.00862	548	2420	807	1400	5050	10000
14100	0.998	0.002	0.00763	620	2740	912	1580	5700	11300
16000	0.999	0.001	0.00674	701	3100	1030	1790	6470	12900
18100	0.999	0.001	0.00596	793	3500	1170	2020	7310	14500
20400	1.000	0.000	0.00527	897	3960	1320	2290	8240	16400
23100	1.000	0.000	0.00466	1010	4480	1490	2590	9340	18600
26200	1.000	0.000	0.00412	1150	5070	1690	2930	10600	21100
29600	1.000	0.000	0.00364	1300	5730	1910	3310	12000	23800
33500	1.000	0.000	0.00322	1470	6490	2160	3750	13500	26900
37800	1.000	0.000	0.00285	1660	7330	2440	4230	15300	30400
43000	1.000	0.000	0.00251	1890	8330	2780	4810	17400	34600
48400	1.000	0.000	0.00223	2120	9380	3130	5410	19600	38900
55000	1.000	0.000	0.00196	2410	10700	3550	6150	22200	44200

Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**5Am**	un-	Host Plug	
Depth (Feet):	4780.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	4160.	-
Swanson Permeability, md:		2080.	-	-
Porosity, fraction:		0.367	0.368	-
maximum Sb/Pc, fraction:		2.66	-	-
R35, microns:		20.5	-	-
R50 (median pore throat radius):		15.5	-	-

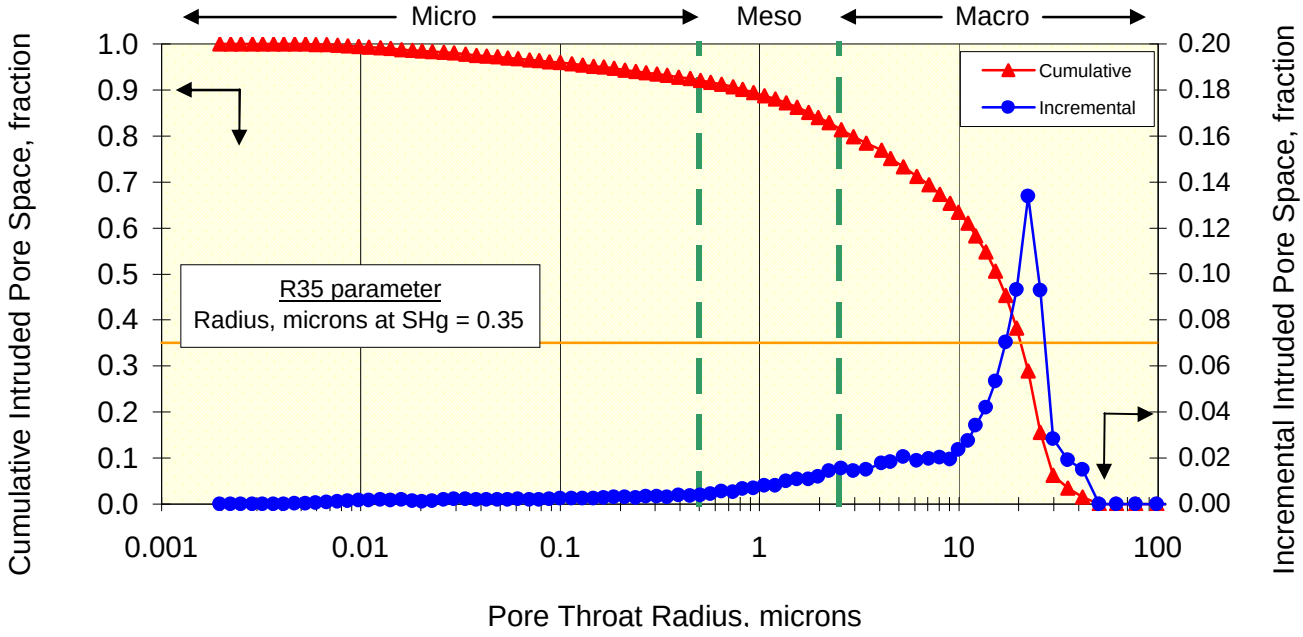
PORE THROAT SIZE HISTOGRAM



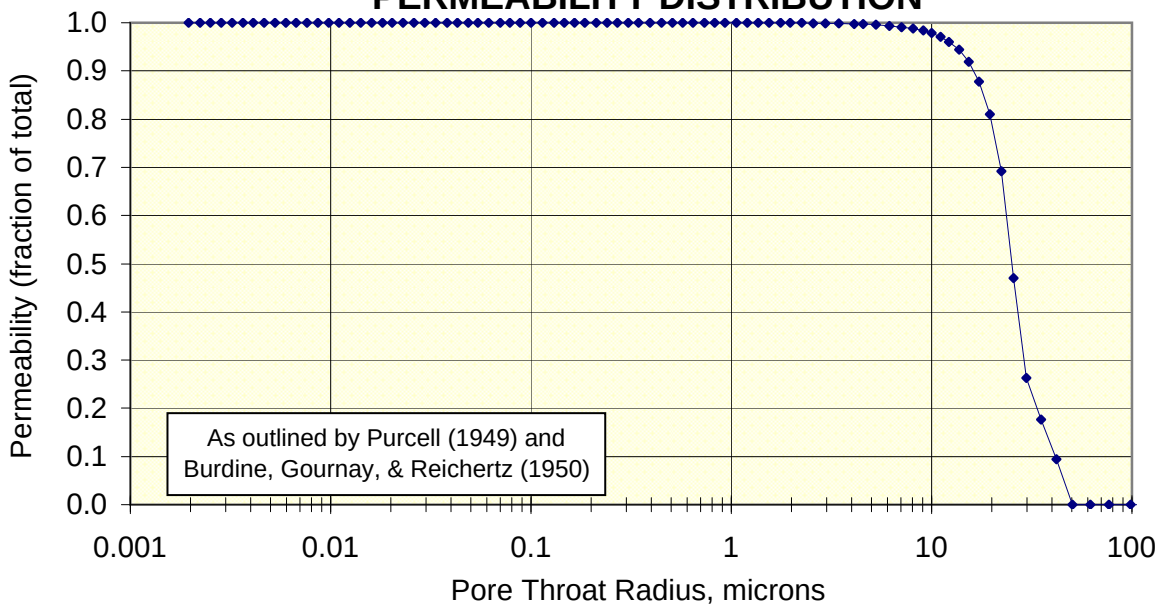
Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**5Am**	un-	Host Plug	
Depth (Feet):	4780.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	4160.	-
Swanson Permeability, md:		2080.	-	-
Porosity, fraction:		0.367	0.368	-
maximum Sb/Pc, fraction:		2.66	-	-
R35, microns:		20.5	-	-
R50 (median pore throat radius):		15.5	-	-

PORE THROAT RADIUS DISTRIBUTION



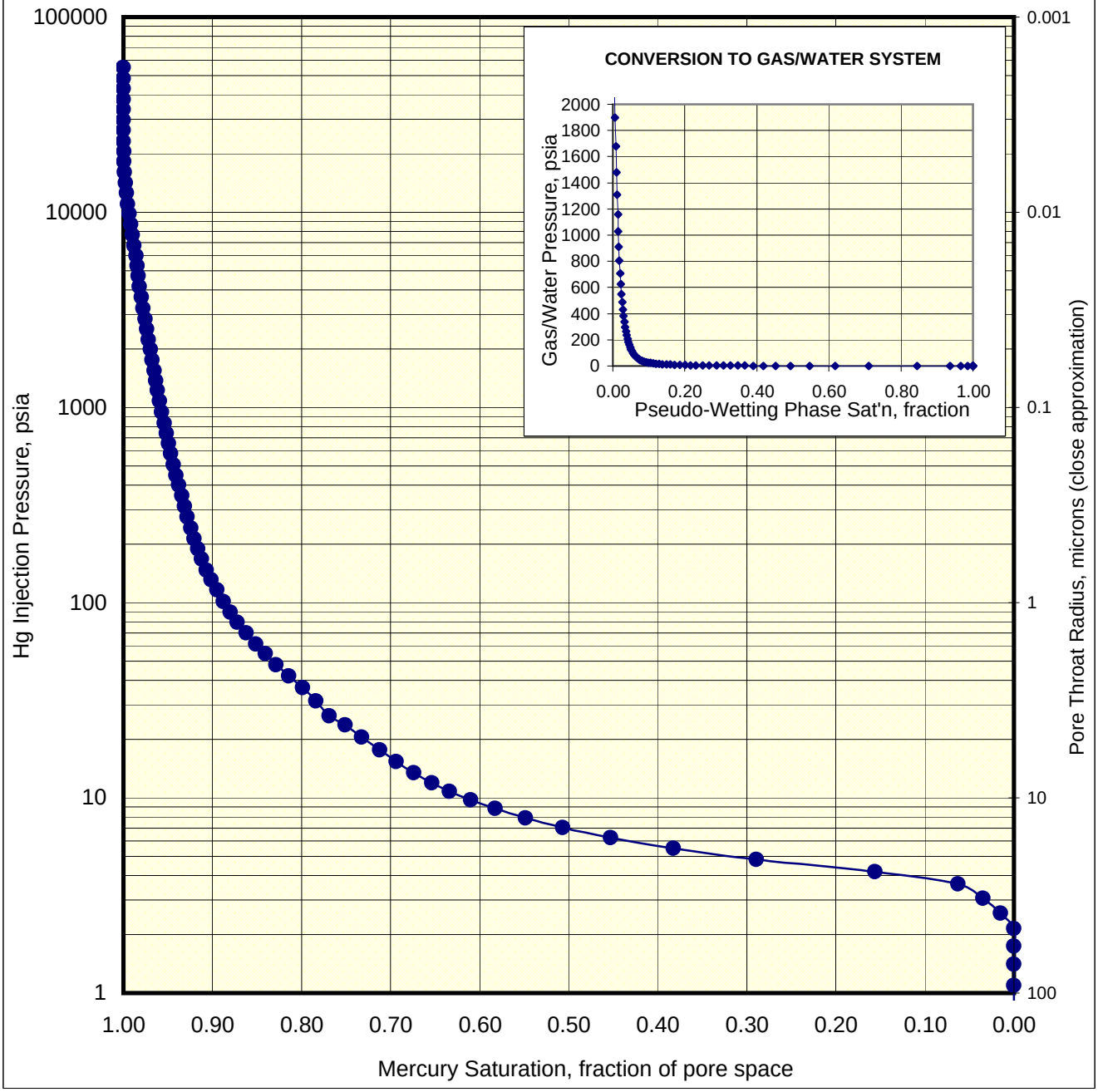
PERMEABILITY DISTRIBUTION



Company:	Pacific Gas & Electric Company
Well:	Piacenine 2-27
Field:	King Island
Location:	San Joaquin County, CA
File:	HOU-130585
	BAK-313024PG

Sample:	**5Am**	un-	Host Plug	
Depth (Feet):	4780.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	4160.	-
Swanson Permeability, md:		2080.	-	-
Porosity, fraction:		0.367	0.368	-
maximum Sb/Pc, fraction:		2.66	-	-
R35, microns:		20.5	-	-
R50 (median pore throat radius):		15.5	-	-

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**6m**	un-	Host Plug	
Depth, feet:	4783.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	716	-
Swanson Permeability, md:		316	-	-
Porosity, fraction:		0.295	0.324	-
maximum Sb/Pc, fraction:		0.871	-	-
R35, microns:		9.03	-	-
R50 (median pore throat radius):		4.52	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
0.82	0.000	1.000	131	0.0156	0.159	0.0530	0.0917	0.331	0.659
1.10	0.000	1.000	97.9	0.0210	0.213	0.0711	0.123	0.445	0.884
1.42	0.000	1.000	75.9	0.0271	0.275	0.0917	0.159	0.574	1.14
1.75	0.000	1.000	61.6	0.0334	0.339	0.113	0.196	0.707	1.41
2.14	0.000	1.000	50.3	0.0408	0.415	0.138	0.239	0.865	1.72
2.58	0.011	0.989	41.8	0.0492	0.500	0.167	0.289	1.04	2.07
3.07	0.022	0.978	35.1	0.0585	0.595	0.198	0.343	1.24	2.47
3.61	0.036	0.964	29.8	0.0688	0.700	0.233	0.404	1.46	2.90
4.20	0.051	0.949	25.7	0.0801	0.814	0.271	0.470	1.70	3.38
4.84	0.070	0.930	22.3	0.0923	0.938	0.313	0.542	1.96	3.89
5.53	0.092	0.908	19.5	0.105	1.07	0.357	0.619	2.23	4.44
6.28	0.118	0.882	17.2	0.120	1.22	0.406	0.703	2.54	5.05
7.05	0.153	0.847	15.3	0.134	1.37	0.455	0.789	2.85	5.67
7.89	0.206	0.794	13.7	0.150	1.53	0.510	0.883	3.19	6.34
8.80	0.249	0.751	12.2	0.168	1.71	0.568	0.985	3.56	7.07
9.74	0.286	0.714	11.1	0.186	1.89	0.629	1.09	3.94	7.83
10.8	0.318	0.682	9.98	0.206	2.09	0.698	1.21	4.36	8.68
11.9	0.349	0.651	9.07	0.227	2.30	0.767	1.33	4.81	9.56
13.4	0.375	0.625	8.05	0.255	2.59	0.865	1.50	5.42	10.8
15.3	0.406	0.594	7.06	0.291	2.96	0.986	1.71	6.18	12.3
17.6	0.438	0.562	6.14	0.335	3.40	1.13	1.96	7.11	14.1
20.4	0.469	0.531	5.29	0.388	3.94	1.31	2.28	8.24	16.4
23.6	0.498	0.502	4.56	0.450	4.58	1.53	2.64	9.54	19.0
26.7	0.526	0.474	4.04	0.508	5.16	1.72	2.98	10.8	21.5
31.5	0.554	0.446	3.42	0.600	6.10	2.03	3.52	12.7	25.3
36.9	0.582	0.418	2.92	0.703	7.14	2.38	4.12	14.9	29.7
42.4	0.609	0.391	2.54	0.807	8.21	2.74	4.74	17.1	34.1
48.3	0.636	0.364	2.23	0.921	9.36	3.12	5.40	19.5	38.8
54.8	0.666	0.334	1.97	1.04	10.6	3.54	6.13	22.1	44.0
62.6	0.690	0.310	1.72	1.19	12.1	4.04	7.00	25.3	50.3
70.7	0.714	0.286	1.53	1.35	13.7	4.56	7.90	28.6	56.8
79.5	0.734	0.266	1.36	1.52	15.4	5.13	8.89	32.1	63.9

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**6m**	un-	Host Plug	
Depth, feet:	4783.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	716	-
Swanson Permeability, md:		316	-	-
Porosity, fraction:		0.295	0.324	-
maximum Sb/Pc, fraction:		0.871	-	-
R35, microns:		9.03	-	-
R50 (median pore throat radius):		4.52	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
89.7	0.754	0.246	1.20	1.71	17.4	5.79	10.0	36.3	72.1
102	0.773	0.227	1.05	1.95	19.8	6.62	11.5	41.2	82.0
115	0.788	0.212	0.935	2.20	22.3	7.45	12.9	46.5	92.4
131	0.805	0.195	0.825	2.49	25.3	8.44	14.6	52.9	105
146	0.818	0.182	0.736	2.79	28.4	9.45	16.4	59.0	117
167	0.832	0.168	0.645	3.19	32.4	10.8	18.7	67.5	134
189	0.845	0.155	0.571	3.60	36.6	12.2	21.1	76.4	152
213	0.855	0.145	0.505	4.07	41.4	13.8	23.9	86.1	171
240	0.866	0.134	0.448	4.58	46.6	15.5	26.9	97.0	193
275	0.877	0.123	0.392	5.24	53.3	17.8	30.8	111	221
311	0.887	0.113	0.347	5.92	60.2	20.1	34.7	126	250
351	0.895	0.105	0.307	6.70	68.1	22.7	39.3	142	282
398	0.904	0.096	0.270	7.60	77.2	25.7	44.6	161	320
450	0.911	0.089	0.240	8.57	87.1	29.0	50.3	182	362
508	0.919	0.081	0.212	9.68	98.4	32.8	56.8	205	408
578	0.926	0.074	0.187	11.0	112	37.3	64.6	234	465
654	0.932	0.068	0.165	12.5	127	42.3	73.2	264	526
733	0.937	0.063	0.147	14.0	142	47.4	82.0	296	589
830	0.942	0.058	0.130	15.8	161	53.6	92.8	335	667
943	0.948	0.052	0.114	18.0	183	60.9	106	381	758
1080	0.953	0.047	0.0998	20.6	209	69.7	121	436	868
1220	0.957	0.043	0.0886	23.2	236	78.6	136	493	981
1370	0.962	0.038	0.0787	26.1	265	88.4	153	554	1100
1540	0.966	0.034	0.0700	29.3	298	99.4	172	622	1240
1750	0.969	0.031	0.0616	33.4	339	113	196	707	1410
1980	0.973	0.027	0.0545	37.7	383	128	221	800	1590
2220	0.976	0.024	0.0486	42.3	430	143	248	897	1780
2510	0.979	0.021	0.0430	47.8	486	162	281	1010	2020
2830	0.982	0.018	0.0381	53.9	548	183	316	1140	2270
3220	0.985	0.015	0.0335	61.4	624	208	360	1300	2590
3660	0.988	0.012	0.0295	69.7	709	236	409	1480	2940
4150	0.991	0.009	0.0260	79.1	804	268	464	1680	3340

MERCURY INJECTION DATA SUMMARY

Core Lab
RESERVOIR OPTIMIZATION

PETROLEUM SERVICES

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

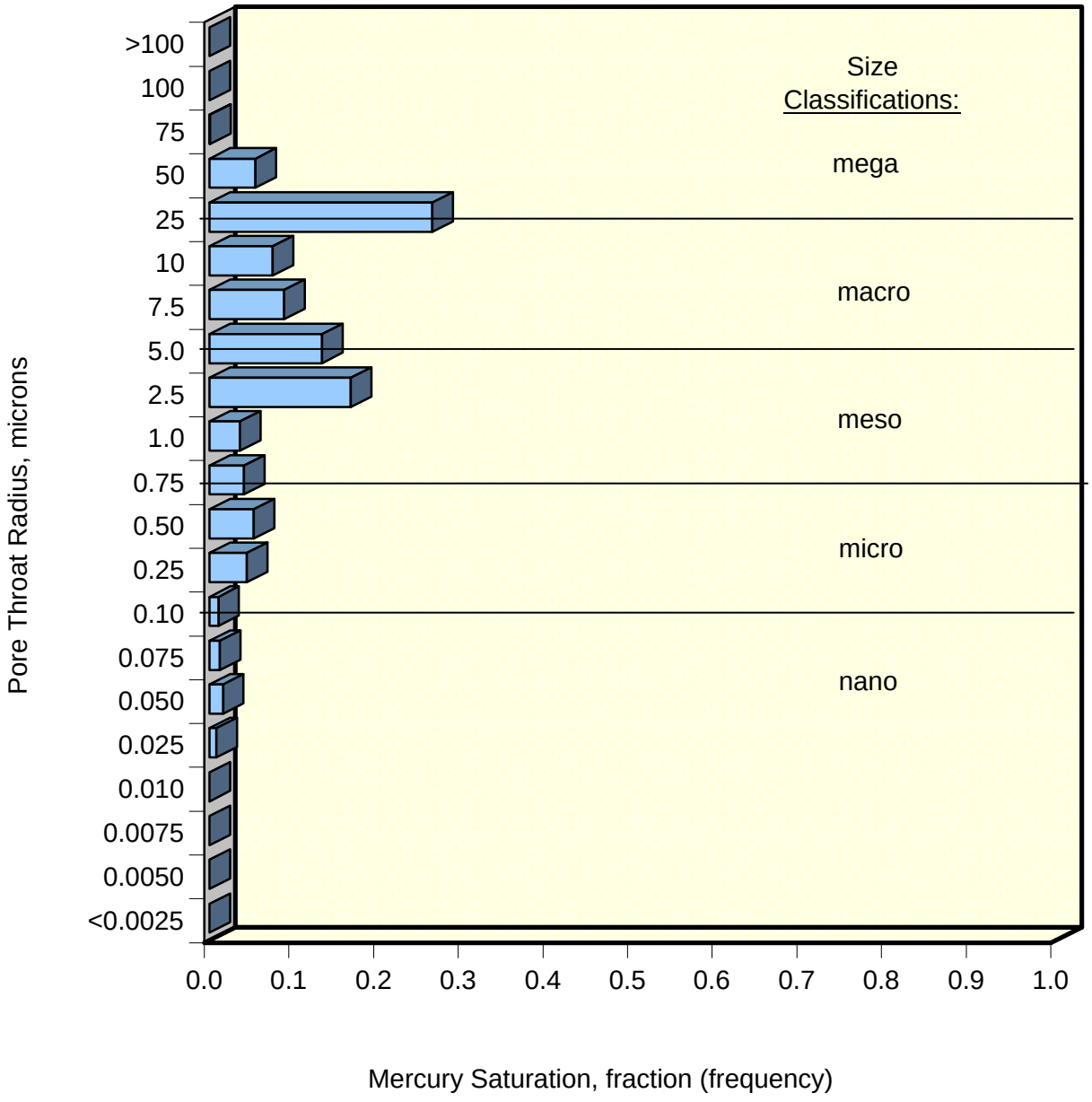
Sample:	**6m**	un-	Host Plug	
Depth, feet:	4783.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	716	-
Swanson Permeability, md:		316	-	-
Porosity, fraction:		0.295	0.324	-
maximum Sb/Pc, fraction:		0.871	-	-
R35, microns:		9.03	-	-
R50 (median pore throat radius):		4.52	-	-

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
4700	0.993	0.007	0.0229	89.5	910	303	525	1900	3780
5300	0.995	0.005	0.0203	101	1030	342	593	2140	4260
5970	0.997	0.003	0.0181	114	1160	385	668	2410	4800
6750	0.998	0.002	0.0160	129	1310	436	755	2730	5430
7650	0.999	0.001	0.0141	146	1480	494	855	3090	6150
8650	0.999	0.001	0.0125	165	1680	559	967	3500	6950
9790	1.000	0.000	0.0110	187	1900	632	1090	3960	7870
11000	1.000	0.000	0.00976	210	2140	713	1230	4450	8840
12500	1.000	0.000	0.00862	238	2420	807	1400	5050	10000
14100	1.000	0.000	0.00763	269	2740	913	1580	5700	11300
16000	1.000	0.000	0.00674	305	3100	1030	1790	6470	12900
18100	1.000	0.000	0.00596	345	3500	1170	2020	7310	14500
20400	1.000	0.000	0.00527	390	3960	1320	2290	8240	16400
23100	1.000	0.000	0.00466	441	4480	1490	2590	9340	18600
26200	1.000	0.000	0.00412	499	5070	1690	2930	10600	21100
29600	1.000	0.000	0.00364	564	5730	1910	3310	12000	23800
33500	1.000	0.000	0.00322	639	6490	2160	3750	13500	26900
37800	1.000	0.000	0.00285	721	7330	2440	4230	15300	30400
43000	1.000	0.000	0.00251	820	8330	2780	4810	17400	34600
48400	1.000	0.000	0.00223	923	9380	3130	5410	19600	38900
55000	1.000	0.000	0.00196	1050	10700	3550	6150	22200	44200

Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample: 6m	un-	Host Plug	
Depth, feet: 4783.90	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	716	-
Swanson Permeability, md:	316	-	-
Porosity, fraction:	0.295	0.324	-
maximum Sb/Pc, fraction:	0.871	-	-
R35, microns:	9.03	-	-
R50 (median pore throat radius):	4.52	-	-

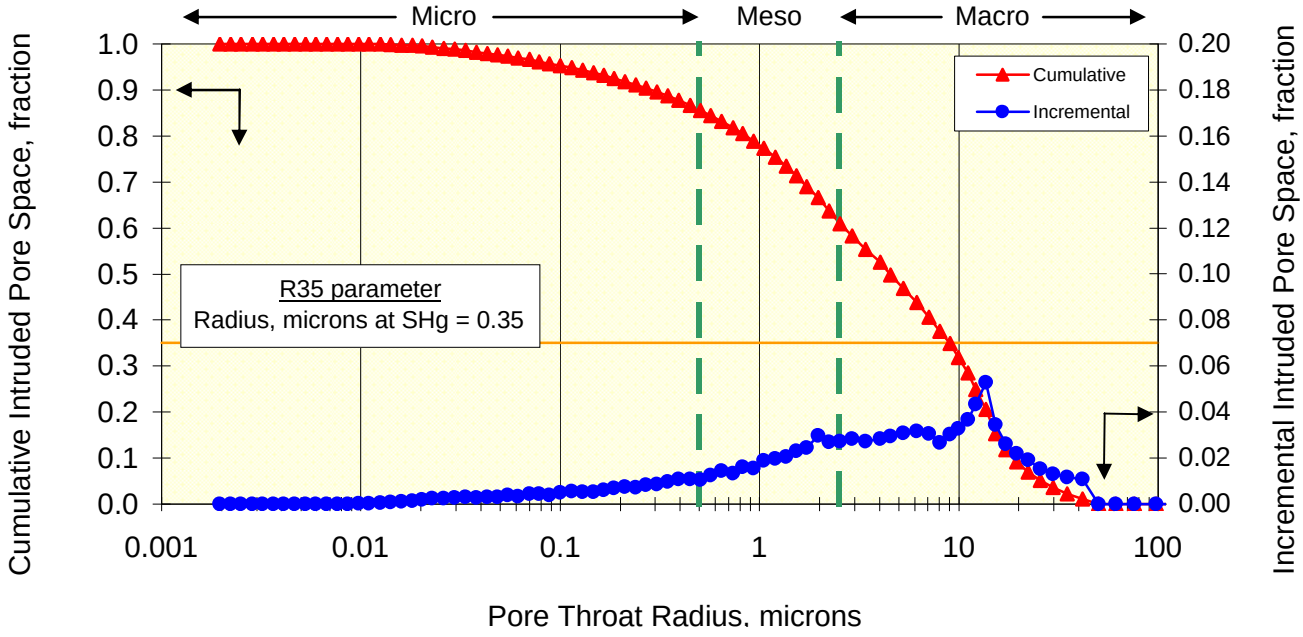
PORE THROAT SIZE HISTOGRAM



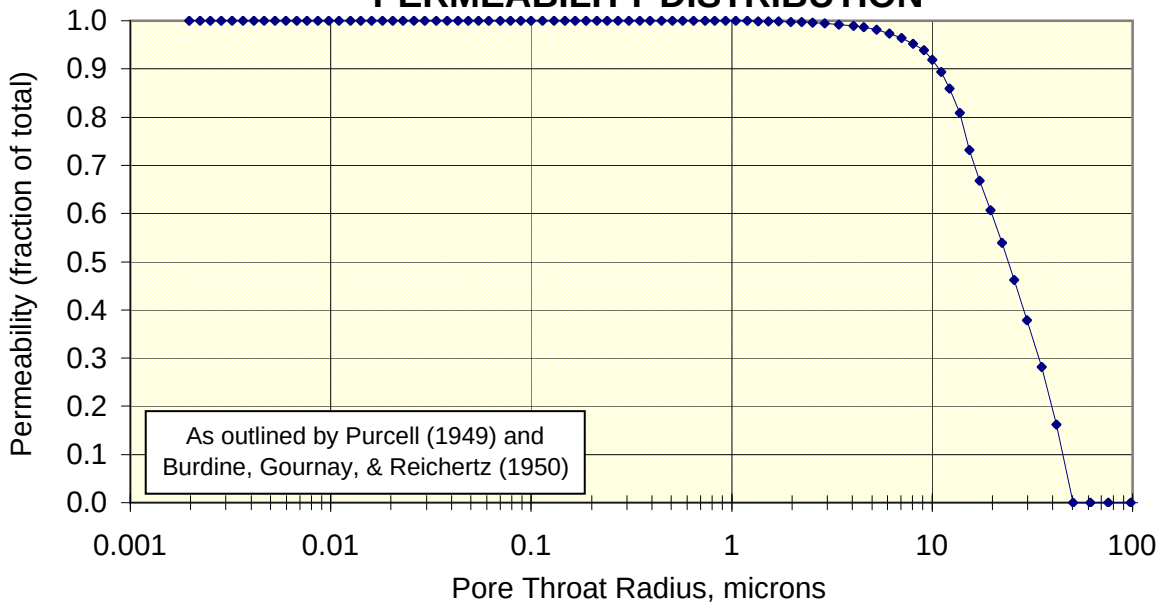
Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample: 6m	un-	Host Plug	
Depth, feet: 4783.90	stressed	250psi	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	716	-
Swanson Permeability, md:	316	-	-
Porosity, fraction:	0.295	0.324	-
maximum Sb/Pc, fraction:	0.871	-	-
R35, microns:	9.03	-	-
R50 (median pore throat radius):	4.52	-	-

PORE THROAT RADIUS DISTRIBUTION



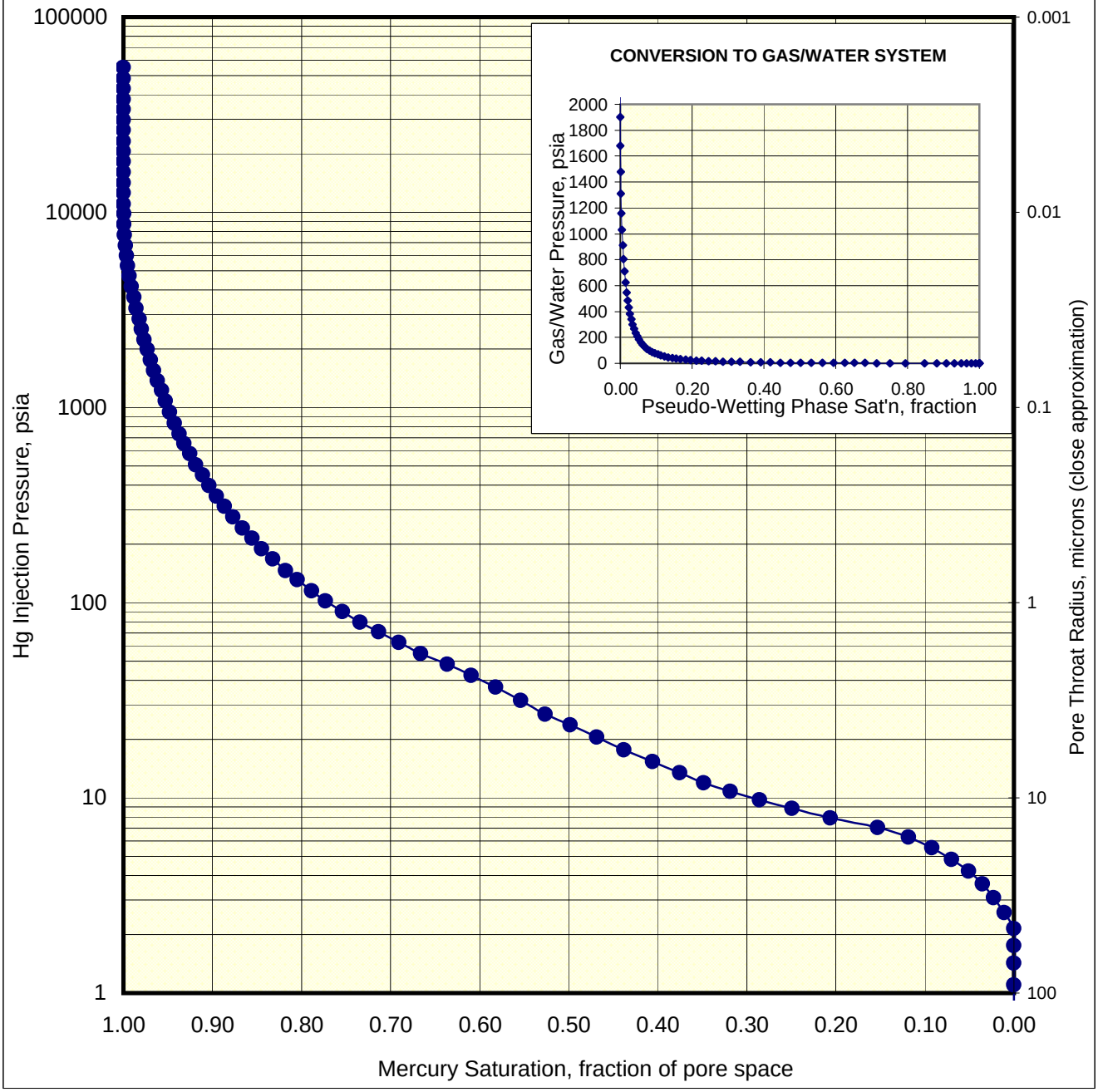
PERMEABILITY DISTRIBUTION



Company: Pacific Gas & Electric Company
Well: Piacentine 2-27
File: HOU-130585
BAK-313024PG

Sample:	**6m**	un-	Host Plug	
Depth, feet:	4783.90	stressed	250psi	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	716	-
Swanson Permeability, md:		316	-	-
Porosity, fraction:		0.295	0.324	-
maximum Sb/Pc, fraction:		0.871	-	-
R35, microns:		9.03	-	-
R50 (median pore throat radius):		4.52	-	-

MERCURY INJECTION



Core Laboratories

SPECIAL CORE ANALYSIS STUDY

Piacentine 2-27 Well
King Island Field
San Joaquin County

Triaxial Report

Performed for:

Pacific Gas and Electric Company
6121 Bollinger Canyon Rd, Rm. 2510C
San Ramon, CA 94583

September 2013

File: 57111-313024PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Petroleum Services Division
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Fax: 661-325-5808
www.corelab.com

September 23, 2013

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm. 2510C
Ventura, CA 94583

Subject: Advanced Rock Properties Study
File: 57111-313024PG

Dear Mr. Chan:

Enclosed are final Triaxial data for three conventional core samples selected by Pacific Gas and Electric Company personnel from Piacentine 2-27 Well, King Island Field, San Joaquin County, California.

This final report contains the test summary, procedures and measured data.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. If you have any questions concerning the enclosed information, or if we can be of any additional service, please contact me at 661-325-5657.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

Larry Kunkel
Area Manager

CLB
Listed
NYSE

Client: Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island

CL File No: 313024PG

SUMMARY OF RESULTS

The Houston Advanced Technology Center of Core Laboratories received three (3) core plug samples from the Piacentine 2-27 well in San Joaquin County, California for triaxial compressive strength measurements. The samples were taken from depths of 4676.90 to 4758.20 feet.

Triaxial Compressive Strength

In a triaxial test, the sample dimensions are accurately measured using three Linear Variable Differential Transducers (LVDT's). One LVDT measures changes in sample circumference and two LVDT's measure changes in sample length as a function of applied stress. The applied stress is calculated based on measurements of applied load using a calibrated pressure gauge to measure the applied pressure.

The triaxial compressive strength tests are commonly used to simulate the in-situ stress conditions of the reservoirs and provide compressive strength and static values of elastic constants: Young's modulus and Poisson's ratio. Young's modulus is the slope of a line when axial stress is plotted against axial strain. An important property of linear-elastic material is the ability to expand in a lateral direction when the load is applied on the material in a vertical direction. This ability to expand laterally is expressed by Poisson's ratio, which is defined by the ratio of lateral expansion to vertical contraction. Poisson's ratio is a critical parameter in determining formation stress and consequently influences fracture height and width.

The triaxial testing, including Young's modulus and Poisson's ratio, performed at multiple net confining stresses, is summarized in the table below.

Triaxial Compressive Strength Results

Sample Number	Depth (m)	Confining Pressure (psi)	Compressive Strength (psi)	Young's Modulus (10^6 psi)	Poisson's Ratio
1RM	4676.90	1010	1343	0.02	0.20
2RM	4720.30	1010	1161	0.01	0.22
3RM	4758.20	1010	1141	0.01	0.20

Client: Pacific Gas and Electric Company CL File No: 313024PG
Well: Piacentine 2-27
Field: King Island

LABORATORY PROCEDURES

Triaxial Compressive Strength

1. Sample length, diameter and mass were measured and recorded. Samples were tested as received.
2. The samples were inserted into rubber jackets and a radial Linear Variable Differential Transducer (LVDT) was placed around the lateral surface of each sample.
3. Each sample was mounted between pistons with ports on the contacting surfaces for controlling pore pressure.
4. The entire assembly was mounted in a pressure vessel that allows application of confining pressure and axial stress. The top piston extends through the top of the pressure vessel enabling the application of axial load.
5. The pressure vessel was then loaded into a computer-controlled load frame where another LVDT is attached for axial strain measurements.
6. The pressure system was inspected for leaks, then confining and axial pressures were increased at the same rate to initial triaxial test conditions.
7. The pressure system was inspected for leaks, then confining and axial pressures were increased at the same rate to the desired hydrostatic testing pressure.
8. Data-logging was begun and the axial load was increased at a constant rate while holding the confining pressure constant.
9. The test was terminated upon attaining the desired level of axial stress or after sample failure. Axial stress was reduced to the hydrostatic condition. Axial and confining pressures were reduced to zero simultaneously.

Triaxial Data Analysis

Deviatory stresses are plotted against both axial strain ε_L (= $\Delta L/L_o$) and radial strain ε_R (= $\Delta R/R_o$). Deviatory stress (σ_d) is defined as the difference between the total axial stress and the confining pressure. Since all the tests were conducted under compressive stresses, compressive stress and contraction (shortening) are considered positive. Accordingly, positive axial strain indicates a shortening of the sample and negative radial strain indicates an increase in the sample diameter during deformation.

The compressive strength is defined as the maximum principal stress (σ_1) achieved during testing, however, the deviatory stresses (σ_1 – Pc) are plotted in the stress-strain curves. Static Young's modulus is determined by taking the slope of the linear elastic part of the curve, plotted on σ_d vs. ε_L space. Static Poisson's ratio (= $-\Delta\varepsilon_R/\Delta\varepsilon_L$) is also determined in a similar way by taking the ratio of the slope of the axial curve to the slope of the radial curve.

TRIAXIAL COMPRESSIVE TEST RESULTS

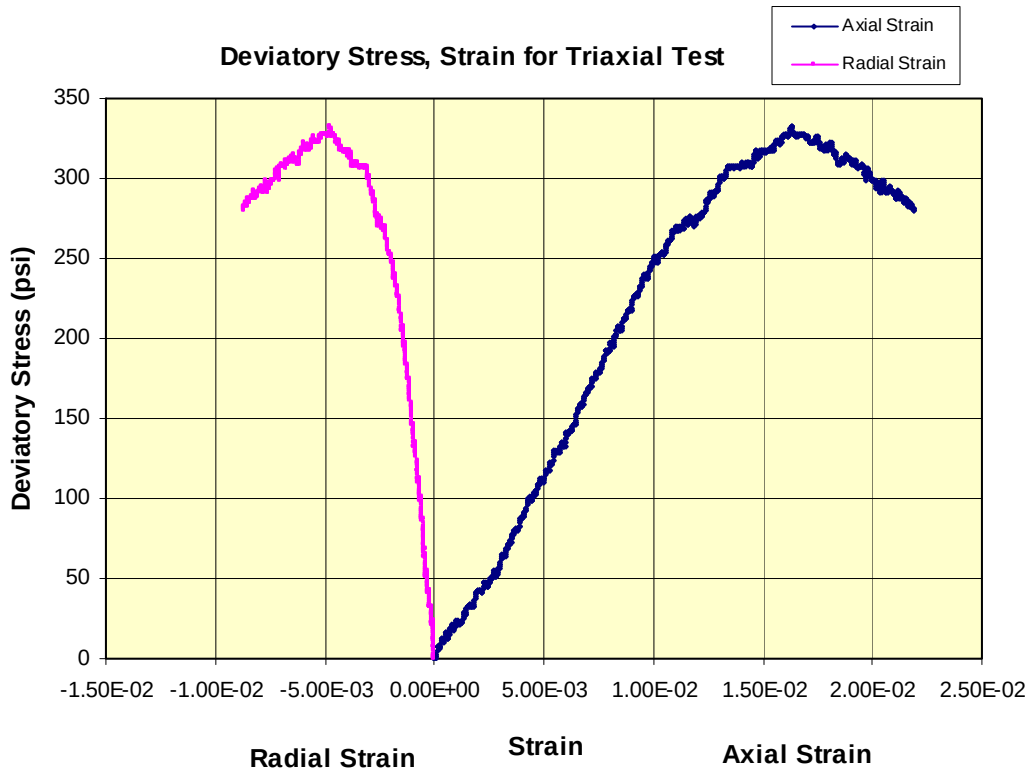
Company:	**Pacific Gas & Electric**	Date:	**Sept, 2013**
Well:	**Piacentine 2-27**	File:	**HOU-130585**
Field	**Kings Island**		**BAK-313024PG**
Location:	**San Joaquin, California**	Saturation Fluid:	**As Received**
		Rock Type:	**Sand**

Triaxial Static Young's Modulus, Poisson's Ratio and Compressive Strength

Sample Number	Depth (ft)	Confining Pressure (psi)	Bulk Density (g/cm^3)	Compressive Strength (psi)	Young's Modulus (10^6 psi)	Poisson's Ratio
1RM	4676.90	1010	2.45	1343	0.02	0.20
2RM	4720.30	1010	2.16	1161	0.01	0.22
3RM	4758.20	1010	2.17	1141	0.01	0.20

Results of Triaxial Test

Company:	**Pacific Gas & Electric**	Date:	**Sept, 2013**
Well:	**Piacentine 2-27**	File:	**HOU-130585**
Field	**Kings Island**		**BAK-313024PG**
Location:	**San Joaquin, California**	Saturation Fluid:	**As Received**
		Rock Type:	**Sand**

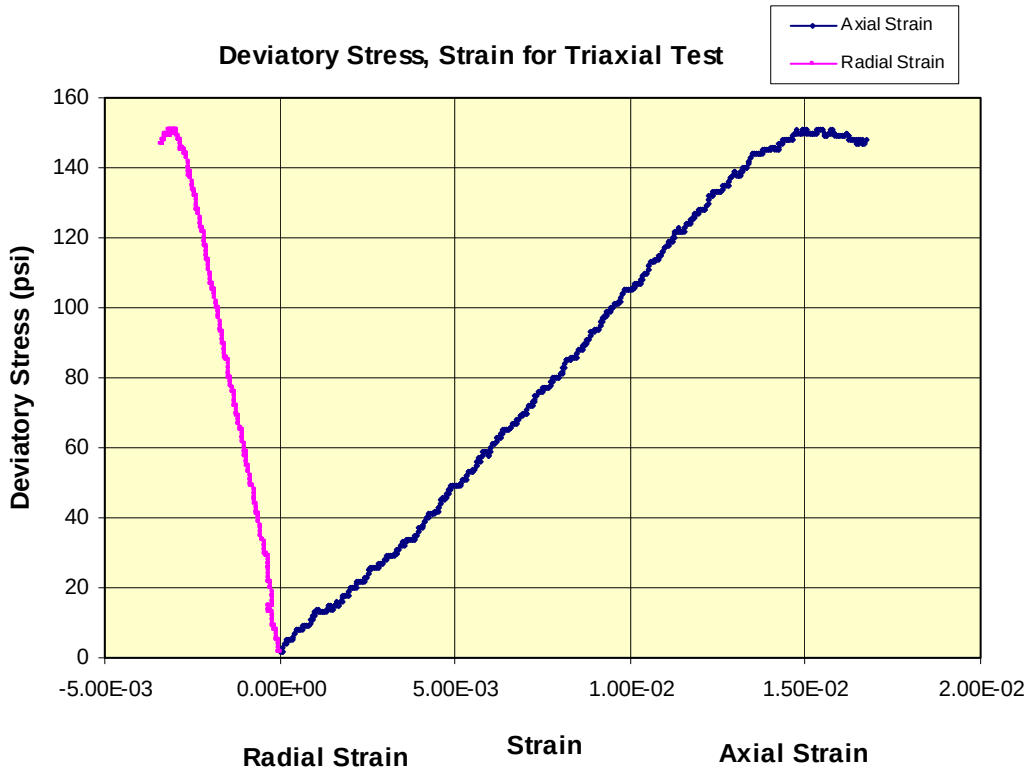


Sample	1RM
Depth (ft)	4676.90
Diameter (in)	1.0152
Length (in)	1.4455
Mass (g)	47
Saturation Fluid	As Received
Bulk Density (g/cm^3)	2.45
Confining Pressure (psi)	1010
Pore Pressure (psi)	0
Static Young's Modulus (X10^6 psi)	0.02
Static Poisson's Ratio	0.20
Compressive Strength (psi)	1343

Core Laboratories

Results of Triaxial Test

Company:	**Pacific Gas & Electric**	Date:	**Sept, 2013**
Well:	**Piacentine 2-27**	File:	**HOU-130585**
Field	**Kings Island**		**BAK-313024PG**
Location:	**San Joaquin, California**	Saturation Fluid:	**As Received**
		Rock Type:	**Sand**

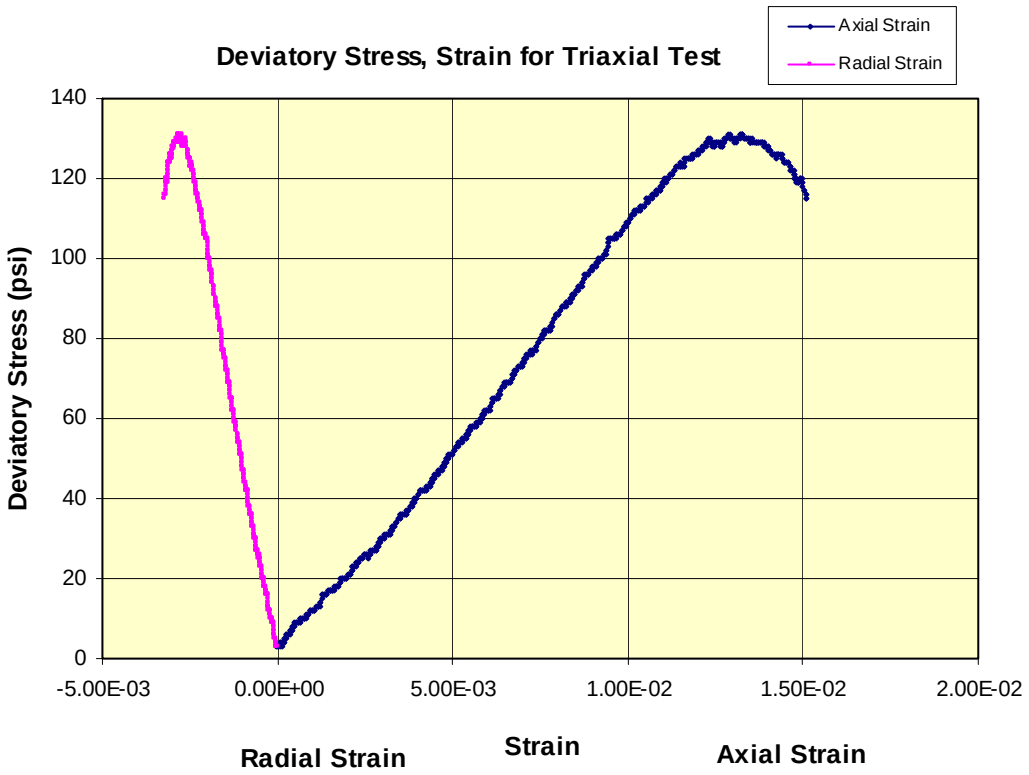


Sample	2RM
Depth (ft)	4720.30
Diameter (in)	1.011
Length (in)	1.4044
Mass (g)	39.9
Saturation Fluid	As Received
Bulk Density (g/cm^3)	2.16
Confining Pressure (psi)	1010
Pore Pressure (psi)	0
Static Young's Modulus (X10^6 psi)	0.01
Static Poisson's Ratio	0.22
Compressive Strength (psi)	1161

Core Laboratories

Results of Triaxial Test

Company:	**Pacific Gas & Electric**	Date:	**Sept, 2013**
Well:	**Piacentine 2-27**	File:	**HOU-130585**
Field	**Kings Island**		**BAK-313024PG**
Location:	**San Joaquin, California**	Saturation Fluid:	**As Received**
		Rock Type:	**Sand**



Sample	3RM
Depth (ft)	4758.20
Diameter (in)	0.971
Length (in)	1.0469
Mass (g)	27.6
Saturation Fluid	As Received
Bulk Density (g/cm^3)	2.17
Confining Pressure (psi)	1010
Pore Pressure (psi)	0
Static Young's Modulus (X10^6 psi)	0.01
Static Poisson's Ratio	0.20
Compressive Strength (psi)	1141

Core Laboratories

SPECIAL CORE ANALYSIS STUDY

Piacentine 2-27 Well
King Island Field
San Joaquin County

Thick Wall Cylinder Report

Performed for:

Pacific Gas and Electric Company
6121 Bollinger Canyon Rd, Rm. 2510C
San Ramon, CA 94583

August 2013

File: 57111-313024PG

Performed by:
Core Laboratories LP
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

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Fax: 661-325-5808
www.corelab.com

August 16, 2013

Joseph Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm. 2510C
Ventura, CA 94583

Subject: Advanced Rock Properties Study
File: 57111-313024PG

Dear Mr. Chan:

Enclosed are final Thick Wall Cylinder data for three conventional core samples selected by Pacific Gas and Electric Company personnel from Piacentine 2-27 Well, King Island Field, San Joaquin County, California.

This final report contains the test summary, procedures and measured data.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. If you have any questions concerning the enclosed information, or if we can be of any additional service, please contact me at 661-325-5657.

Sincerely,
Core Laboratories

Stephen Carter
Senior Core Analyst

Larry Kunkel
Area Manager

CLB
Listed
NYSE

Client: Pacific Gas and Electric Company
Well: Piacentine 2-27
Field: King Island

CL File No: 313024PG

SUMMARY OF RESULTS

The Houston Advanced Technology Center of Core Laboratories received three (3) samples from the Piacentine 2-27 well. The samples ranged in depth from 4756.40 to 4779.10 feet.

Geomechanical Analysis - Thick Wall Cylinder

Hole stability and sanding predictions are best simulated in the laboratory by performing a thick-wall cylinder test (also known as a hole collapse test). This test provides a direct measure of the stress required to cause hole failure in the particular formation interval of interest. The sample is in the form of a hollow cylinder, with a 3:1 ratio of sample diameter (1-inch) to hole diameter (0.3-inch). The pressure acting on the outer diameter (thick wall) of the cylindrical sample results in a stress concentration around the hole. This is similar to the stress concentration that occurs downhole around the wellbore. When the stress around the hole exceeds a critical stress for rock failure, the sample will collapse inward and the hole is filled with loose materials from the wall. Three (3) samples were submitted for this test, and the results are summarized below.

Thick Wall Cylinder

Sample Number	Depth (ft)	Internal Hole Failure Initiation Pressure (psi)	Internal Hole Total Failure Pressure (psi)	External Failure Initiation Pressure (psi)	External Total Failure Pressure (psi)
1TWC	4756.40	200	267	219	267
2TWC	4773.70	158	195	177	195
3TWC	4779.10	171	303	175	303

LABORATORY PROCEDURES

Thick Wall Cylinder

1. The sample, a hollow cylinder, with a 3:1 ratio of sample diameter (1.5 inch) to hole diameter (0.5 inch), was inserted into a rubber jacket and a radial LVDT was placed around the lateral surface of the sample.
2. The sample was mounted between pistons with ports on the contacting surfaces for controlling pore pressure.
3. The entire assembly was then mounted in a pressure vessel that allowed application of confining pressure.
4. The pressure vessel was then loaded into a computer controlled load frame.
5. Logging of data was begun and the confining pressure was increased at a constant rate.
6. Axial strain, radial strain and balance weight were continuously monitored and recorded.
7. All data recording was stopped after sample failed or confining pressure reached 20,000-psi.

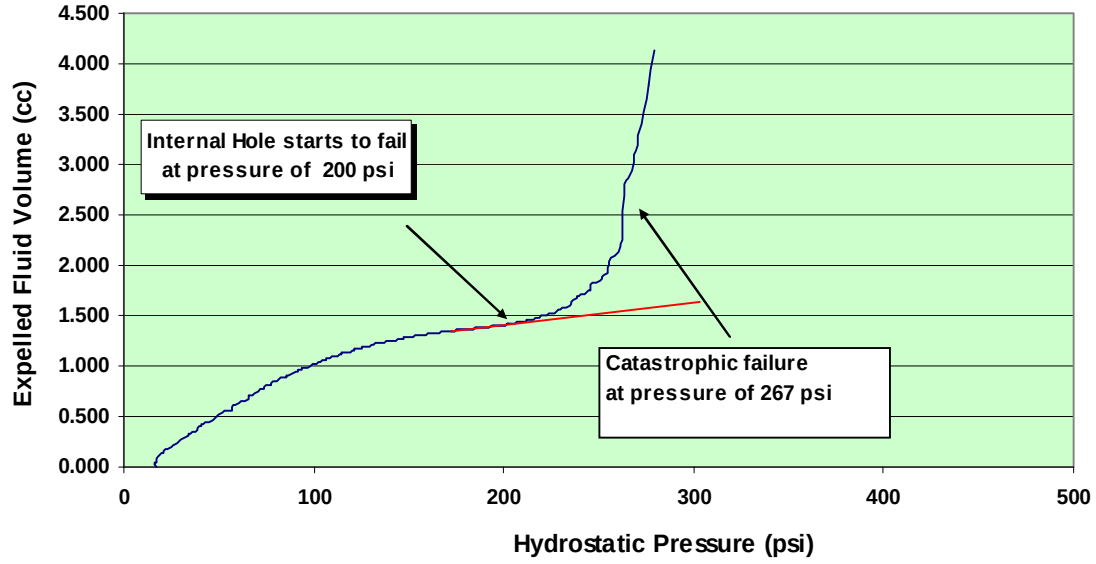
THICK WALL CYLINDER TEST RESULTS

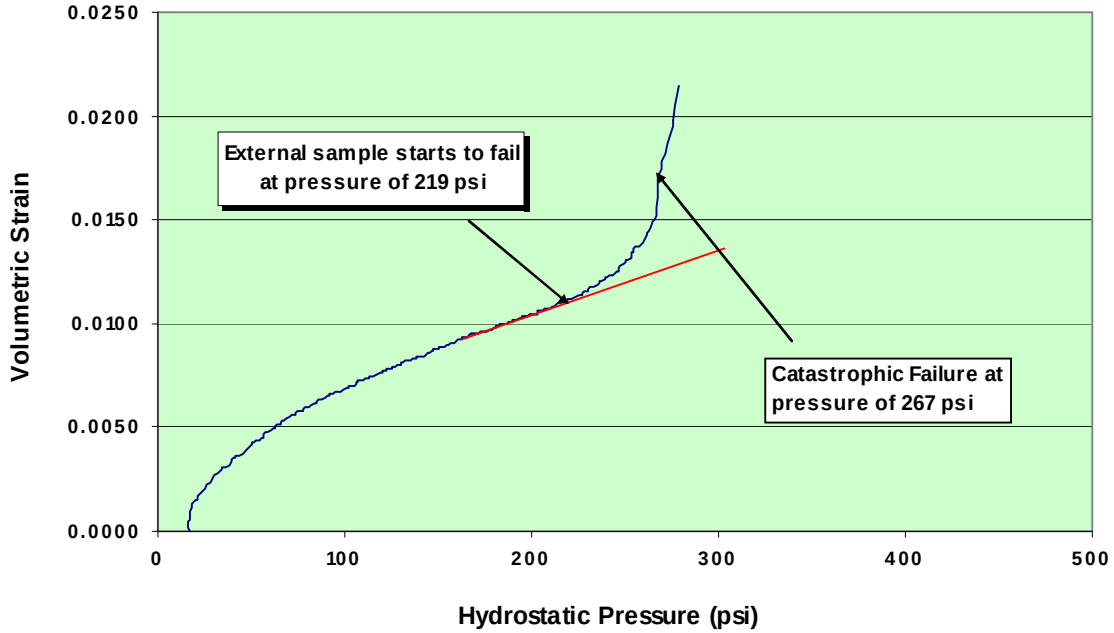
Company	**Pacific Gas & Electric Company**	Time		**Aug. 2013**
Well Name	**Piacentine 2-27**	Job No.	BAK-313024PG	**HOU-130585**
Field Name	**n/a**	Saturation Fluid		**As Received**
Location	**n/a**	Rock Type		**Sandstone**

Sample Number	Depth (ft)	Sample Length (in)	Sample OD (in)	Sample ID (in)	Internal Hole Failure Initiation Pressure (psi)	Internal Hole Total Failure Pressure (psi)	External Failure Initiation Pressure (psi)	External Total Failure Pressure (psi)
1TWC	4756.40	2.4867	1.4613	0.5013	200	267	219	267
2TWC	4773.70	2.5529	1.4843	0.5030	158	195	177	195
3TWC	4779.10	2.8095	1.4904	0.5025	171	303	175	303

Thick Wall Cylinder Test

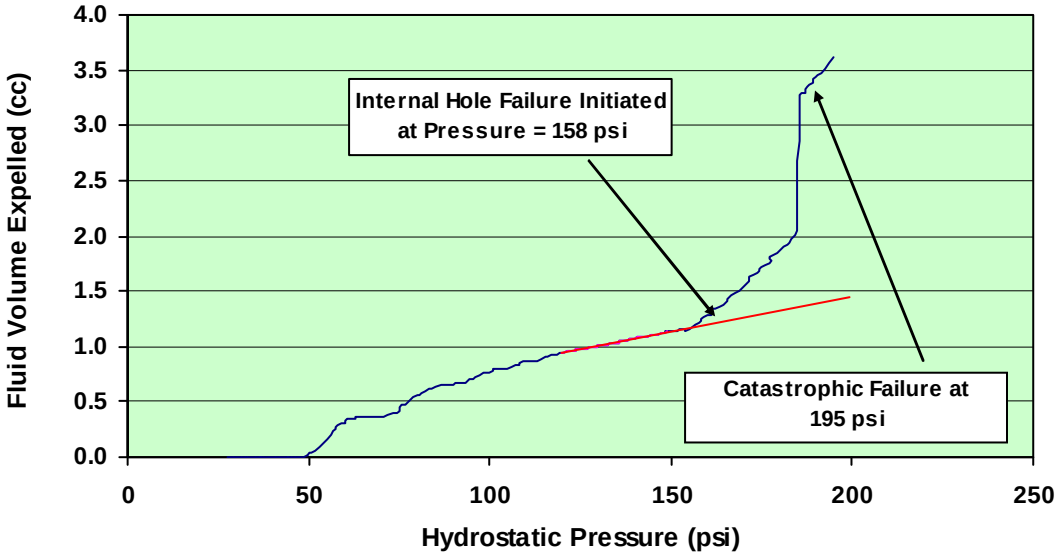
Company:	**Pacific Gas & Electric Company**	Sample No.:	**1TWC**
Well:	**Piacentine 2-27**	Depth (ft):	**4756.40**
File: BAK-313024PG	**HOU-041059**	Sample Length (in):	**2.4867**
Saturation Fluid:	**As Received**	Sample Diameter (in):	**1.4613**
Rock Type	**Sandstone**	Hole Diameter (in):	**0.5013**
Internal Hole Begin to Failure (psi):	**200**	Internal Hole Catastrophic Failure (psi):	**267**
External Wall Begin to Failure (psi):	**219**	External Wall Catastrophic Failure (psi):	**267**

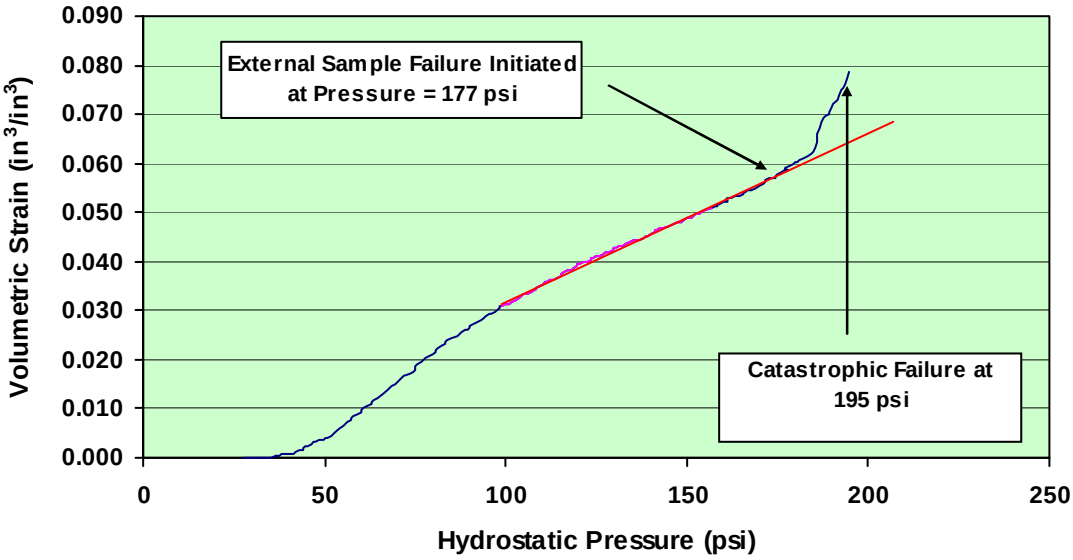




Thick Wall Cylinder Test

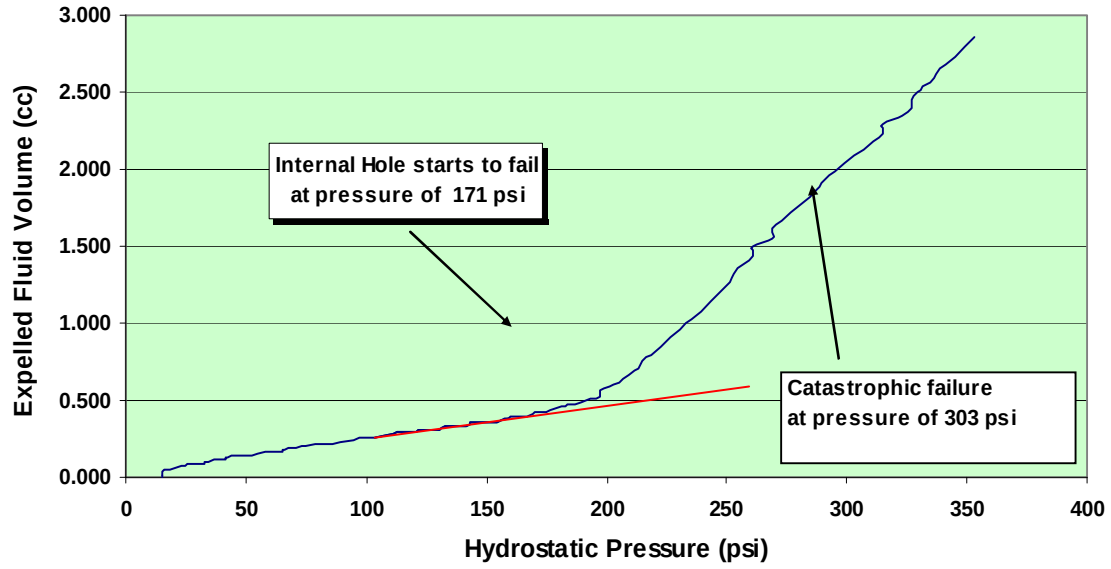
Company:	**Pacific Gas & Electric Company**	Sample No.:	**2TWC**
Well:	**Piacemtine 2-27**	Depth (ft):	**4773.70**
File: BAK-313024PG	**HOU-130585**	Sample Length (in):	**2.5529**
Saturation Fluid:	**As Received**	Sample Diameter (in):	**1.4843**
Rock Type	**Sandstone**	Hole Diameter (in):	**0.5030**
Internal Hole Begin to Failure (psi):	**158**	Internal Hole Catastrophic Failure (psi):	**195**
External Wall Begin to Failure (psi):	**177**	External Wall Catastrophic Failure (psi):	**195**

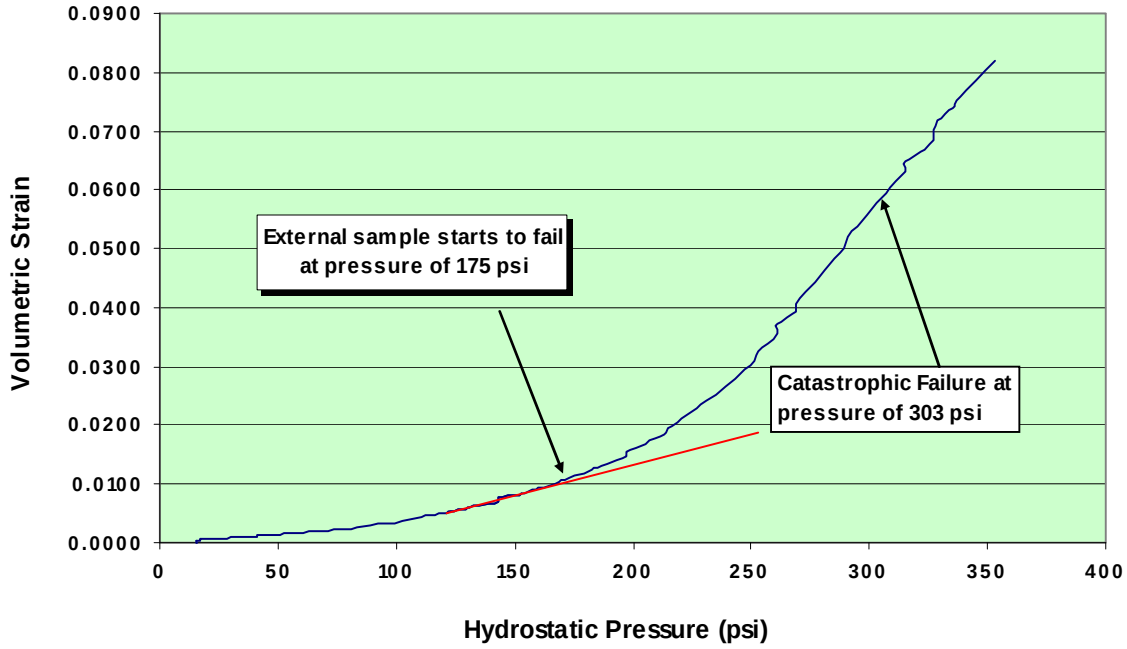




Thick Wall Cylinder Test

Company:	**Pacific Gas & Electric Company**	Sample No.:	**3TWC**
Well:	**Piacentine 2-27**	Depth (ft):	**4779.10**
File: BAK-313024PG	**HOU-041059**	Sample Length (in):	**2.8095**
Saturation Fluid:	**As Received**	Sample Diameter (in):	**1.4904**
Rock Type	**Sandstone**	Hole Diameter (in):	**0.5025**
Internal Hole Begin to Failure (psi):	**171**	Internal Hole Catastrophic Failure (psi):	**303**
External Wall Begin to Failure (psi):	**175**	External Wall Catastrophic Failure (psi):	**303**





Core Lab
RESERVOIR OPTIMIZATION

Petroleum Services

Geochemical Analysis

Pacific Gas and Electric Company

Piacentine 2-27 Well

King Island Field
San Joaquin County, California

FINAL REPORT

April 29, 2013

CL File: 57111-513082PG

Performed by:
Core Laboratories, Inc.
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations or profitableness, however, of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever.

Petroleum Services Division
3437 Landco Dr.
Bakersfield, California 93308
Tel: 661-325-5657
Fax: 661-325-5808
www.corelab.com

April 29, 2013

Joseph C. Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm 2510C
San Ramon, CA 94583

Subject: Geochemical Analysis
File No.: 57111-513082PG

Dear Mr. Chan:

Enclosed are final geochemical data for produced water samples submitted to our laboratory from well Piacentine 2-27, King Island Field, San Joaquin County, CA.

Geochemical analysis was performed on a rush basis as requested by PG&E. One water sample was analyzed by Zalco Laboratories, Bakersfield. The remaining two water samples are being held in referigerated storaged pending additional analysis.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. Please do not hesitate to contact us at (661-325-5657) if you have any questions regarding these results or if we can be of any additional service.

Sincerely,
Core Laboratories

Larry Kunkel
Area Manager - West Coast

Distribution: 1 original report, 1 CD copy: Addressee

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

4309 Armour Avenue
Bakersfield, California 93308

(661) 395-0539
FAX (661) 395-3069

Core Laboratories
3437 Landco Dr
Bakersfield CA 93308

Laboratory No: 1304060-01
Date Received: 4/5/2013
Date Reported: 4/9/2013

Attention: Larry Kunkel

Sample Identification: Chamber 1507
Sampled by: Date: 3/26/2013 Time:
Report Notes:

COMPLETE GEOCHEM ANALYSIS

pH	7.68	Specific Gravity @ 60 F...	1.009
Electrical Conductivity (EC) *(millimhos/cm @ 25 C)*	21.3	Resistivity (ohm meters @ 25 C)	0.4695

Constituents	mg/L	meq/L	Reacting %
Calcium, Ca	430	21	4.72
Magnesium, Mg	130	11	2.35
Sodium, Na	4300	190	41.14
Potassium, K	33	0.84	0.19
Iron, Fe (total)	< 1.0	0	0
Alkalinity as:			
Hydroxide, OH	0	0	0
Carbonate, CO3	0	0	0
Bicarbonate, HCO3	150	2.5	0.54
Chloride, Cl	8200	230	50.86
Sulfate, SO4	42	0.87	0.19
Sulfide, S	< 1.0		
Boron, B	9.6		
Barium, Ba	3.2		
Silica, SiO2	< 40		
Strontium, Sr	15		
Totals (Sum)	13200	456	100

Total Dissolved Solids, (Gravimetric)	14000		
Calculated Hardness, CaCO3	1600		
Total Alkalinity, CaCO3	150		
Sodium Chloride, (total)	13000		
		Primary Salinity	82.66
		Secondary Salinity	14.14
		Total Salinity	96.8
Cation/Anion Balance, %	3.0%		
Sodium, Na (Calculated), mg/L	4635.12	Primary Alkalinity	0
Langelier Scale Index	1.13	Secondary Alkalinity	0
Stiff/Davis Stability Index	1.11	Total Alkalinity	0

Laboratory Authorization

This report is furnished for the exclusive use of our Customer and applies only to the samples tested. Zalco is not responsible for report alteration or detachment.

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

4309 Armour Avenue
Bakersfield, California 93308

(661) 395-0539
FAX (661) 395-3069

Core Laboratories, Inc.	Project: Master	Work Order No.: **1304060**
3437 Landco Drive	Project #: Placentine 2-27	Reported: 04/15/2013
Bakersfield, CA 93308	Attention: Larry Kunkel	Received: 04/05/2013 08:20

Lab Sample ID: **1304060-01**	Collected By:
Client Sample ID: Chamber 1507	Date Collected: 3/26/2013 12:00:00AM

Analyte	Results	PQL		Units	Flag	Method	Date Prepared	Date Analyzed	Init.
Alkalinity									
Total Alkalinity	150	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
Bicarbonate (HCO3)	150	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
Carbonate (CO3)	<10	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
Hydroxide (OH)	<10	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
General Chemistry			*MCL Limits*						
Fluoride	<1.0	1.0	*2*	mg/L		EPA 300.0	4/5/13	4/5/13	LME
Nitrate as NO3	<20	20	*45*	mg/L		EPA 300.0	4/5/13	4/5/13	LME
Sulfide	<1.0	1.0		mg/L		SM 4500-S F	4/5/13	4/5/13	SS
Total Suspended Solids	32	2.5		mg/L	I-02	SM 2540 D	4/5/13	4/5/13	SAM
Electrical Conductivity	21	0.010		mmhos/cm		SM 2510B	4/5/13	4/5/13	SAM
Nitrite as NO2	<10	10		mg/L	I-02	EPA 353.2	4/5/13	4/5/13	LME
Phosphate (as PO4)	<0.30	0.30		mg/L		SM4500P E	4/5/13	4/5/13	LME
Resistivity	0.4695	0.01000		Ohm-Meters		SM 2510 B	4/9/13	4/9/13	MAC
Ammonium as NH4	13	1.0		mg/L		SM4500NH3D	4/8/13	4/8/13	MSS
Bromide	34	1.0		mg/L		EPA 300.0	4/5/13	4/5/13	LME
Chloride	8200	500		mg/L		EPA 300.0	4/5/13	4/5/13	LME
pH	7.68			pH Units	I-02	EPA 150.1	4/5/13	4/5/13	SAM
Sulfate as SO4	42	5.0		mg/L		EPA 300.0	4/5/13	4/5/13	LME
Total Dissolved Solids	14000	10		mg/L	I-02	SM 2540C	4/5/13	4/5/13	SAM
Hardness									
Hardness (as CaCO3)	1600	2.0		mg/L		SM 2340B	4/5/13	4/5/13	SS
Metals - As Received									
Aluminum	<500	500		ug/L		EPA 200.7	4/5/13	4/15/13	SS
Magnesium	130	0.50		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Potassium	33	5.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Sodium	4600	70		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Calcium	430	0.50		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Iron	<1.0	1.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Boron	9.6	1.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Barium	3.2	1.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Copper	<0.50	0.50		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Silica (SiO2)	<40	40		mg/L		EPA 200.7	4/5/13	4/5/13	SS

NSS: Non Sufficient Sample H: Exceeds Analysis Hold Time TTLC: Total Threshold Limit Concentration STLC: Soluble Threshold Limit Concentration TCLP: Toxicity Characteristic Leaching Procedure MCL: Maximum Contaminant Level *: See Case Narrative
The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Note: Samples analyzed for regulatory purposes should be put on ice immediately after sampling and received by the laboratory at temperatures between 0-6°C. Microbiological analysis requires samples to be at least 4-10°C when received at the laboratory. For additional information regarding the limitations of the method(s) referred to, please call us at 661-395-0539.

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

4309 Armour Avenue
Bakersfield, California 93308

(661) 395-0539
FAX (661) 395-3069

Core Laboratories, Inc.	Project: Master	Work Order No.: **1304060**
3437 Landco Drive	Project #: Placentine 2-27	Reported: 04/15/2013
Bakersfield, CA 93308	Attention: Larry Kunkel	Received: 04/05/2013 08:20

Lab Sample ID: **1304060-01** Collected By:

Client Sample ID: Chamber 1507 Date Collected: 3/26/2013 12:00:00AM

Analyte	Results	PQL	Units	Flag	Method	Date Prepared	Date Analyzed	Init.
Metals - As Received								
Strontium	15	1.0	mg/L		EPA 200.7	4/5/13	4/5/13	SS
Manganese	<0.30	0.30	mg/L		EPA 200.7	4/5/13	4/5/13	SS
Zinc	<0.50	0.50	mg/L		EPA 200.7	4/5/13	4/15/13	SS
Petroleum Chemistry								
Specific Gravity @ 60/60 °F	1.009				ASTM D 4052	4/9/13	4/9/13	MAC

NSS: Non Sufficient Sample H: Exceeds Analysis Hold Time TTLC: Total Threshold Limit Concentration STLC: Soluble Threshold Limit Concentration TCLP: Toxicity Characteristic Leaching Procedure MCL: Maximum Contaminant Level *: See Case Narrative
The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Note: Samples analyzed for regulatory purposes should be put on ice immediately after sampling and received by the laboratory at temperatures between 0-6°C. Microbiological analysis requires samples to be at least 4-10°C when received at the laboratory. For additional information regarding the limitations of the method(s) referred to, please call us at 661-395-0539.

CAPCO
Analytical Services, Inc.

CERTIFICATE OF ANALYSIS

Client: Zalco
CAS LAB NO: 131138
Analyst: LL

Date Sampled: 03/26/13
Date Received: 04/05/13
Date Analyzed: 04/05/13
Sample Matrix: Water

Total Organic Carbon
Standard Method 5310B

CAS Lab #	Sample ID	RESULTS (mg/L)	Dilution Factor	PQL (mg/L)	MDL (mg/L)
131138-01	1304060-01	21	10	2.0	0.40

QUALITY CONTROL REPORT

130405-MB	Method Blank	ND	1	0.2	0.04

1536 Eastman Ave. Ste B Ventura CA 93003 (805) 644-1095
www.capcoenv.com

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386336 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-1A Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	nd			
Hydrogen	nd			
Argon	0.0214			
Oxygen	21.58			
Nitrogen	78.40			
Carbon Dioxide	nd			
Methane	nd			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386337 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-1B Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	nd			
Hydrogen	nd			
Argon	0.0209			
Oxygen	21.61			
Nitrogen	78.37			
Carbon Dioxide	nd			
Methane	nd			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386338 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-2A Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	nd			
Hydrogen	nd			
Argon	0.0217			
Oxygen	21.63			
Nitrogen	78.33			
Carbon Dioxide	nd			
Methane	0.0157			
Ethane	0.0001			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386339 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-2B Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	nd			
Hydrogen	nd			
Argon	0.0222			
Oxygen	21.58			
Nitrogen	78.39			
Carbon Dioxide	nd			
Methane	0.0056			
Ethane	0.0001			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386340 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-3A Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	0.0191			
Hydrogen	nd			
Argon	0.0214			
Oxygen	21.47			
Nitrogen	78.45			
Carbon Dioxide	0.028			
Methane	0.0092			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386341 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-3B Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	0.0218			
Hydrogen	nd			
Argon	0.0217			
Oxygen	21.33			
Nitrogen	78.58			
Carbon Dioxide	0.045			
Methane	0.0053			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386342 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-3B Duplicate Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	0.0212			
Hydrogen	nd			
Argon	0.0212			
Oxygen	21.34			
Nitrogen	78.57			
Carbon Dioxide	0.045			
Methane	0.0053			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386343 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-4A Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	0.0322			
Hydrogen	0.0130			
Argon	0.0213			
Oxygen	21.14			
Nitrogen	78.63			
Carbon Dioxide	0.13			
Methane	0.0335			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC

ANALYSIS REPORT

Lab #: 386344 Job #: 23132 IS-67468 Co. Job#:
Sample Name: ACT1-4B Co. Lab#:
Company: Core Laboratories
Date Sampled: / /
Container: 75 ml stainless
Field/Site Name: Air Chamber Test 1
Location:
Formation/Depth:
Sampling Point:
Date Received: 10/08/2013 Date Reported: 10/10/2013

Component	Chemical mol. %	$\delta^{13}C$ ‰	δD ‰	$\delta^{15}N$ ‰
Carbon Monoxide	nd			
Helium	0.0331			
Hydrogen	0.0161			
Argon	0.0226			
Oxygen	20.95			
Nitrogen	78.70			
Carbon Dioxide	0.25			
Methane	0.0271			
Ethane	nd			
Ethylene	nd			
Propane	nd			
Propylene	nd			
Iso-butane	nd			
N-butane	nd			
Iso-pentane	nd			
N-pentane	nd			
Hexanes +	nd			

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 0
Specific gravity, calculated: 0.997

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

ISOTECH
ISOTECH LABORATORIES INC
www.isotechlabs.com

Isotech Gas Data

Job 23132
CoreTrac IS-67468

nd = not detected, na = not analyzed

Isotech Lab No.	Sample Name	Field Name	GC Date	He %	H_2 %	Ar %	O_2 %	CO_2 %	N_2 %	CO %	C_1 %	C_2 %	C_2H_4 %	C_3 %	C_3H_6 %	iC_4 %	nC_4 %	iC_5 %	nC_5 %	C_6+ %	Specific Gravity	BTU
386336	ACT1-1A	Air Chamber Test 1	10/9/2013	nd	nd	0.0214	21.58	nd	78.40	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386337	ACT1-1B	Air Chamber Test 1	10/9/2013	nd	nd	0.0209	21.61	nd	78.37	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386338	ACT1-2A	Air Chamber Test 1	10/9/2013	nd	nd	0.0217	21.63	nd	78.33	nd	0.0157	0.0001	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386339	ACT1-2B	Air Chamber Test 1	10/9/2013	nd	nd	0.0222	21.58	nd	78.39	nd	0.0056	0.0001	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386340	ACT1-3A	Air Chamber Test 1	10/9/2013	0.0191	nd	0.0214	21.47	0.028	78.45	nd	0.0092	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386341	ACT1-3B	Air Chamber Test 1	10/9/2013	0.0218	nd	0.0217	21.33	0.045	78.58	nd	0.0053	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386342	ACT1-3B Duplicate	Air Chamber Test 1	10/9/2013	0.0212	nd	0.0212	21.34	0.045	78.57	nd	0.0053	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386343	ACT1-4A	Air Chamber Test 1	10/9/2013	0.0322	0.0130	0.0213	21.14	0.13	78.63	nd	0.0335	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0
386344	ACT1-4B	Air Chamber Test 1	10/9/2013	0.0331	0.0161	0.0226	20.95	0.25	78.70	nd	0.0271	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.997	0

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MG0475																																							
Standard Expected Value		0		0		0		0		0		99.9989		0		0.0002		0.0001		0		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		
Date	Lab/Std	He	He %	Ar	Ar %	H2	H2 %	O2	O2 %	CO2	CO2 %	N2	N2 %	CO	CO %	C1	C1 %	C2	C2 %	C2H2	C2H2 %	C2H4	C2H4 %	C3	C3 %	C3H6	C3H6 %	IC4	IC4 %	NC4	NC4 %	IC5	IC5 %	NC5	NC5 %	C6+	C6+ %	Raw Total
10/9/2013	MG0475	0		0.0716		0		0.00105		0		99.92618	99.93	0		0.00022	109.63	0.0001	99.67	0		0.00011	109.63	0.0001	99.67	0.00011	109.63	0.0001	99.67	0.00013	129.56	0.00011	109.63	0.00011	109.63	0.00009	89.7	100
10/9/2013	MG0475	0		0.06875		0		0		0		99.9301	99.93	0		0.00021	104.88	0.00011	109.88	0		0.0001	99.89	0.00009	89.9	0.00011	109.88	0.00011	109.88	0.00012	119.87	0.0001	99.89	0.0001	99.89	0.0001	99.89	100
MG0476																																							
Standard Expected Value		0.01044		0.0996		0.00994		0.0498		1.49105		51.30129		0		39.66203		2.97217		0		0.49662		1.73956		0.12913		0.74612		0.74612		0.24851		0.24801		0.0496		
Date	Lab/Std	He	He %	Ar	Ar %	H2	H2 %	O2	O2 %	CO2	CO2 %	N2	N2 %	CO	CO %	C1	C1 %	C2	C2 %	C2H2	C2H2 %	C2H4	C2H4 %	C3	C3 %	C3H6	C3H6 %	IC4	IC4 %	NC4	NC4 %	IC5	IC5 %	NC5	NC5 %	C6+	C6+ %	Raw Total
10/9/2013	MG0476	0.01038	99.41	0.1248	125.29	0.01221	122.82	0.04669	93.75	1.50727	101.09	51.27524	99.95	0		39.39162	99.32	3.07954	103.61	0		0.49593	99.86	1.79295	103.07	0.12434	96.3	0.78721	105.51	0.77994	104.53	0.26694	107.42	0.25436	102.56	0.05059	101.99	100.6

Attachment G-2
Morias 16-2
Ambient and Stress Porosity and Horizontal Permeability Averages
Meganos Channel Formation Reservoir Sands

	Horizontal Permeability Averages (mD)	
Porosity Arithmetic Mean (%)	Ambient (250 psi)	Stress (Corrected to 2,700 psi)
33.7	4,668	1,771

Depth (feet)	Porosity (%) at Ambient Stress (250 psi)	Porosity (%) at Confining Stress (2700 psi)	Horizontal Permeability (mD) at Ambient Stress (250 psi)	Horizontal Permeability (mD) at Confining Stress (2,700 psi)	Ratio Stress to Ambient Pressure
4685.00	35.9	27.07	2,771.1	6.6	0.002
4690.80	36.2	31.27	4,194.5	179.2	0.043
4697.00	32.7	27.68	14,194.9	1,037.6	0.073
4705.10	36.2	31.92	6,194.1	2,393.2	0.386
4712.00	32.7	30.12	8,007.3	830.7	0.104
4714.70	35.1	29.97	2,115.5	1,039.3	0.491
4717.00	35.6	30.72	2,563.8	1,876.1	0.732
4719.10	34.2	31.16	1,611.3	2,180.6	1.353
4723.80	35.5	29.74	5,914.8	1,481.0	0.250
4726.10	34.7	31.36	5,523.0	2,447.0	0.443
4728.90	37.1	31.45	4,954.5	2,297.6	0.464
4736.00	36.1	31.25	5,546.8	1,932.6	0.348
4751.00	32.5	28.57	11,525.9	2,777.0	0.241
Averages:	35.0	30.2	5,778.3	1,575.3	0.379

Notes:

No laboratory-measured vertical permeability data are available for the aquitard that underlies the reservoir; therefore, both upper-bound and lower bound vertical permeabilities were calculated for simulation purposes. As an upper-bound estimate of the vertical permeability, available vertical permeability data for a sample from the Capay shale and two samples of siltstone/sandstone in the upper "shaled out" portion of the Mokelumne River Formation reservoir at the Piacentine 2-27 core well were used to calculate a harmonic average permeability. Data from these samples and lithologies were selected because they were believed to be representative of the materials encountered in the base-of-reservoir aquitard during drilling and logging of the Piacentine 2-27 core well, and from interpretation of the logs for other wells in the King Island Gas Field. Based on these data, the aquitard consists of interbedded shale, silty sandstone and siltstone. The 0.4 mD sample was selected as representing the shale beds because it is the median of three available vertical permeabilities measured in samples from the Capay Shale.

Attachment G-2
Morias #16-2
Meganos Channel Formation Reservoir Sands
Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)
4649.5	29.6	46.1
4650.5	29.8	1.3
4651.5	28.6	52.5
4652.5	28.9	5.9
4653.5	32.2	52.3
4654.5	32.8	75.6
4655.5	34.6	168.3
4656.5	32.3	3.2
4657.5	32.5	121.2
4658.5	35.0	204.0
4659.5	33.7	349.1
4660.5	33.6	242.1
4661.5	33.7	561.4
4662.5	33.2	149.6
4663.5	32.5	486.6
4664.5	32.6	148.5
4665.5	32.8	237.1
4666.5	34.1	250.4
4667.5	32.1	78.8
4668.5	28.9	0.92
4669.5	32.1	12.3
4670.5	33.6	0.19
4671.5	35.8	1.4
4672.5	31.6	0.14
4673.5	29.5	0.32
4674.5	32.0	26.9
4675.5	28.7	1.3
4676.5	30.3	0.31
4677.5	29.2	1.01
4678.5	26.5	2.5
4679.5	34.8	12.1
4680.5	28.5	116.2
4681.5	31.3	340.4
4682.5	37.7	4797.0
4683.5	37.3	10019.7
4684.5	37.3	2838.9
4685.5	35.9	2771.1

Attachment G-2
Morias #16-2
Meganos Channel Formation Reservoir Sands
Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)
4686.5	34.2	5291.6
4687.5	35.3	4957.9
4688.5	35.8	5397.6
4689.5	35.2	2782.2
4690.5	36.2	4194.5
4691.5	31.0	6.6
4692.5	32.8	267.0
4693.5	35.4	3900.0
4694.5	34.3	5309.3
4695.5	34.0	6793.8
4696.5	34.4	14179.6
4697.5	32.7	14194.9
4698.5	30.9	3043.1
4699.5	30.4	65.3
4700.5	35.6	1184.3
4701.6	32.3	2449.6
4702.5	38.3	8555.4
4703.3	36.5	9104.6
4704.5	36.2	6194.1
4705.5	35.7	10074.9
4706.5	35.3	10882.2
4707.5	35.9	8250.2
4708.5	35.4	10015.5
4709.5	33.3	5523.9
4710.6	34.6	3452.5
4711.6	32.7	8007.3
4712.5	31.0	3809.1
4713.5	29.6	116.8
4714.5	35.1	2115.5
4715.5	35.6	5782.7
4716.5	35.6	2563.8
4717.5	38.3	1436.5
4718.5	34.2	1611.3
4719.5	37.2	614.5
4720.5	36.6	1406.5
4721.5	35.8	6250.2
4722.5	34.5	6945.7

Attachment G-2
Morias #16-2
Meganos Channel Formation Reservoir Sands
Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)
4723.5	35.5	5914.8
4724.5	37.0	5487.2
4725.5	36.6	5295.6
4726.5	34.7	5523.0
4727.5	35.2	2694.3
4728.7	35.0	321.1
4729.5	37.1	4954.6
4730.5	37.7	7013.3
4731.5	34.7	6371.3
4732.4	37.0	10489.5
4733.5	36.1	2972.2
4734.5	34.3	3602.0
4735.5	36.1	5546.8
4736.5	35.1	6181.2
4737.5	34.8	9325.6
4738.5	38.7	6017.6
4739.5	37.3	6321.3
4740.5	36.4	2573.1
4741.5	33.3	8.4
4742.6	35.6	3904.3
4743.5	34.0	7.1
4744.5	33.4	12157.0
4745.4	34.1	12356.4
4746.5	32.6	7356.8
4747.5	33.3	10126.7
4748.6	34.5	2834.7
4749.5	34.5	19097.6
4750.5	32.5	11525.9
4751.5	33.5	13516.7
4752.5	35.8	20638.0
4753.5	34.7	19057.5
4754.5	32.3	8865.0
4755.5	30.7	6610.0
4756.5	31.9	9007.4
4757.5	32.8	19466.8
4758.8	34.0	22297.6
4759.5	33.4	9362.7

Attachment G-2
Morias #16-2
Meganos Channel Formation Reservoir Sands
Porosity and Permeability (at 250 psi)

Depth	Porosity (%)	Permeability (mD)
4760.5	29.8	4489.1
4761.5	31.4	7643.7
4762.5	29.4	3968.3
4763.5	29.2	6578.2
4764.5	29.1	3076.8

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013
Core Type: Conventional Cores

Core Analysis Procedures and Conditions

	Procedure (1)	Procedure (2)	Procedure (3)	Procedure (4)	Procedure (5)
Sampling Method	Arbor Cut	Drilled	Drilled	Drilled	Carved
Drill Coolant	N/A	Liquid Nitrogen	Liquid Nitrogen	Liquid Nitrogen	N/A
Jacket Material	Lead/Nickel	Lead/Nickel	None	None	None
Saturation Method	Dean Stark (Toluene)	Dean Stark (Toluene)	Dean Stark (Toluene)	Dean Stark (Toluene)	Dean Stark (Toluene)
Porosity Method					
Grain Volume	Boyle's Law (Helium)	Boyle's Law (Helium)	Boyle's Law (Helium)	Boyle's Law (Helium)	Bulk Vol-Pore Vol
Pore Volume	Boyle's Law (Helium)	Boyle's Law (Helium)	Bulk Vol-Grain Vol	Boyle's Law (Helium)	Bulk Vol-Grain Vol
Bulk Volume	Pore Vol + Grain Vol	Pore Vol + Grain Vol	Mercury Displacement	Pore Vol + Grain Vol	Mercury Displacement
Permeability Method	Air	Air	Air	Air	Emprical

Common Conditions

Sleeved Sample Seating Pressure: Depth - 100 (Mav 750 psig)

Confining Pressure Pore Vol & Permeability: 250 psig

Samples Dried At 235 Degrees Fahrenheit

Additional Extraction by Soxhlet with Methylene Chloride/Methanol

For Mthd Definition See Procedures Page

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
1	4649.5 F/	46.1	29.6	0.0	96.6	0.00	96.6	2.19	2.70	2	Mdst gy vslty calc no stn no flor
2	4650.5	1.3	29.8	0.0	99.4	0.00	99.4	2.20	2.70	2	Mdst gy vslty calc no stn no flor
3	4651.5 F/	52.5	28.6	0.0	98.8	0.00	98.8	2.22	2.70	2	Mdst gy vslty calc no stn no flor
4	4652.5	5.9	28.9	0.0	99.8	0.00	99.8	2.21	2.70	2	Mdst gy vslty calc no stn no flor
5	4653.5 F/	52.3	32.2	0.0	98.4	0.00	98.4	2.16	2.71	2	Mdst gy vslty calc no stn no flor
6	4654.5 F/	75.6	32.8	0.0	99.8	0.00	99.8	2.15	2.70	2	Mdst gy vslty calc no stn no flor
7	4655.5 F/	168.3	34.6	0.0	99.1	0.00	99.1	2.11	2.70	2	Mdst gy vslty calc no stn no flor
8	4656.5	3.2	32.3	0.0	98.5	0.00	98.5	2.16	2.71	2	Mdst gy slty calc no stn no flor
9	4657.5 F/	121.2	32.5	0.0	92.6	0.00	92.6	2.13	2.70	2	Mdst gy vslty calc no stn no flor
10	4658.5 F/	204.0	35.0	0.0	92.1	0.00	92.1	2.09	2.71	2	Mdst gy vslty calc no stn no flor
11	4659.5 F/	349.1	33.7	0.0	99.6	0.00	99.6	2.13	2.70	2	Mdst gy vslty calc no stn no flor
12	4660.5 F/	242.1	33.6	0.0	99.5	0.00	99.5	2.13	2.70	2	Mdst gy slty scalc no stn no flor
13	4661.5 F/	561.4	33.7	0.0	97.7	0.00	97.7	2.12	2.69	2	Mdst gy vslty calc no stn no flor
14	4662.5 F/	149.6	33.2	0.0	99.1	0.00	99.1	2.14	2.71	2	Mdst gy vslty calc no stn no flor
15	4663.5 F/	486.6	32.5	0.0	98.3	0.00	98.3	2.15	2.70	2	Mdst gy vslty calc no stn no flor
16	4664.5 F/	148.5	32.6	0.0	99.5	0.00	99.5	2.15	2.70	2	Mdst gy vslty calc fos no stn no flor
17	4665.5 F/	237.1	32.8	0.0	99.4	0.00	99.4	2.15	2.71	2	Mdst gy vslty calc no stn no flor
18	4666.5 F/	250.4	34.1	0.0	99.9	0.00	99.9	2.13	2.71	2	Mdst gy vslty calc no stn no flor
19	4667.5 F/	78.8	32.1	0.0	92.9	0.00	92.9	2.14	2.71	2	Mdst gy vslty calc no stn no flor
20	4668.5	0.92	28.9	0.0	99.6	0.00	99.6	2.22	2.72	2	Sltst gy sdy vcly vcalc no stn no flor
21	4669.5 F/	12.3	32.1	0.0	99.9	0.00	99.9	2.15	2.69	2	Mdst gy vslty calc no stn no flor
22	4670.5	0.19	33.6	0.0	99.7	0.00	99.7	2.17	2.75	2	Mdst gy sdy vslty fos no stn no flor
23	4671.5	1.4	35.8	0.0	99.5	0.00	99.5	2.14	2.76	2	Mdst gy sdy vslty calc no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
24	4672.5	0.14	31.6	0.0	99.3	0.00	99.3	2.20	2.75	2	Mdst gy sdy vslty calc no stn no flor
25	4673.5	0.32	29.5	0.0	98.3	0.00	98.3	2.21	2.72	2	Mdst gy sdy vslty calc no stn no flor
26	4674.5 F/	26.9	32.0	0.0	98.1	0.00	98.1	2.16	2.71	2	Mdst gy sdy vslty calc no stn no flor
27	4675.5	1.3	28.7	0.0	98.5	0.00	98.5	2.25	2.75	2	Mdst gy sdy vslty calc no stn no flor
28	4676.5	0.31	30.3	0.0	99.0	0.00	99.0	2.23	2.77	2	Mdst gy sdy vslty calc fos no stn no flor
29	4677.5	1.01	29.2	0.0	96.0	0.00	96.0	2.27	2.81	2	Mdst gy sdy/pbly vslty calc no stn no flor
30	4678.5	2.5	26.5	0.0	93.9	0.00	93.9	2.30	2.78	2	Mdst gy sdy/pbly vslty calc no stn no flor
31	4679.5	12.1	34.8	0.0	89.6	0.00	89.6	2.14	2.79	2	Sd gy vf-pbly vslty scly calc no stn no flor
32	4680.5	116.2	28.5	0.0	86.6	0.00	86.6	2.18	2.69	2	Sd gy vf-pbly slty scly scalc no stn no flor
33	4681.5	340.4	31.3	0.0	81.2	0.00	81.2	2.10	2.68	2	Sd gy vf-vcgr/pbly slty scly mica no stn no flor
34	4682.5	4797.0	37.7	0.0	71.2	0.00	71.2	1.92	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
35	4683.5	10019.7	37.3	0.0	47.5	0.00	47.5	1.84	2.64	2	Sd gy vf-mgr sslty smica no stn no flor
36	4684.5	2838.9	37.3	0.0	67.1	0.00	67.1	1.92	2.66	2	Sd gy vf-mgr sslty mica no stn no flor
37	4685.5	2771.1	35.9	0.0	59.6	0.00	59.6	1.91	2.64	2	Sd gy vf-mgr sslty mica no stn no flor
38	4686.5	5291.6	34.2	0.0	52.4	0.00	52.4	1.93	2.65	2	Sd gy vf-mgr/vcgr sslty mica no stn no flor
39	4687.5	4957.9	35.3	0.0	52.7	0.00	52.7	1.91	2.65	2	Sd gy vf-mgr sslty mica vslty-vmica lam no stn no flor
40	4688.5	5397.6	35.8	0.0	53.3	0.00	53.3	1.89	2.65	2	Sd gy vf-mgr sslty mica no stn no flor
41	4689.5	2782.2	35.2	0.0	57.6	0.00	57.6	1.92	2.65	2	Sd gy vf-fgr sslty mica no stn no flor
42	4690.5	4194.5	36.2	0.0	54.3	0.00	54.3	1.89	2.65	2	Sd gy vf-mgr sslty mica no stn no flor
43	4691.5	6.6	31.0	0.0	91.1	0.00	91.1	2.13	2.67	2	Slt gy vsdy vcly mica no stn no flor
44	4692.5	267.0	32.8	0.0	87.0	0.00	87.0	2.10	2.69	2	Sd gy vf-mgr slty vmica no stn no flor
45	4693.5	3900.0	35.4	0.0	84.8	0.00	84.8	2.00	2.62	2	Sd gy vf-mgr sslty no stn no flor
46	4694.5	5309.3	34.3	0.0	82.9	0.00	82.9	2.02	2.64	2	Sd gy vf-mgr sslty mica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
47	4695.5	6793.8	34.0	0.0	79.6	0.00	79.6	2.02	2.64	2	Sd gy vf-mgr/vcgr sslty no stn no flor
48	4696.5	14179.6	34.4	0.0	26.7	0.00	26.7	1.83	2.64	2	Sd gy vf-mgr/vcgr smica sslty no stn no flor
49	4697.5	14194.9	32.7	0.0	26.2	0.00	26.2	1.86	2.64	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
50	4698.5	3043.1	30.9	0.0	55.8	0.00	55.8	2.02	2.66	2	Sd gy vf-cgr sslty smica no stn no flor
51	4699.5	65.3	30.4	0.0	98.0	0.00	98.0	2.16	2.67	2	Sd gy vf-fgr vslty cly vmica no stn no flor
52	4700.5	1184.3	35.6	0.0	72.4	0.00	72.4	1.98	2.67	2	Sd gy vf-fgr sslty-slty smica no stn no flor
53	4701.6	2449.6	32.3	0.0	66.0	0.00	66.0	2.02	2.66	2	Sd gy vf-fgr/cgr sslty smica no stn no flor
54	4702.5	8555.4	38.3	0.0	52.5	0.00	52.5	1.84	2.65	2	Sd gy vf-mgr sslty smica no stn no flor
55	4703.3	9104.6	36.5	0.0	48.3	0.00	48.3	1.87	2.66	2	Sd gy vf-mgr sslty smica no stn no flor
56	4704.5	6194.1	36.2	0.0	76.0	0.00	76.0	1.97	2.65	2	Sd gy vf-mgr sslty mica no stn no flor
57	4705.5	10074.9	35.7	0.0	65.8	0.00	65.8	1.94	2.65	2	Sd gy vf-cgr sslty smica no stn no flor
58	4706.5	10882.2	35.3	0.0	77.3	0.00	77.3	1.99	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
59	4707.5	8250.2	35.9	0.0	73.9	0.00	73.9	1.97	2.65	2	Sd gy vf-fgr sslty smica no stn no flor
60	4708.5	10015.5	35.4	0.0	45.8	0.00	45.8	1.87	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
61	4709.5	5523.9	33.3	0.0	56.7	0.00	56.7	1.97	2.66	2	Sd gy vf-mgr sslty smica no stn no flor
62	4710.6	3452.5	34.6	0.0	77.6	0.00	77.6	2.01	2.66	2	Sd gy vf-mgr sslty smica no stn no flor
63	4711.6	8007.3	32.7	0.0	51.3	0.00	51.3	1.96	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
64	4712.5	3809.1	31.0	0.0	73.5	0.00	73.5	2.06	2.65	2	Sd gy vf-mgr sslty smica no stn no flor
65	4713.5 F/	116.8	29.6	0.0	83.7	0.00	83.7	2.15	2.70	2	Sd gy vfgr vslty cly mica no stn no flor
66	4714.5	2115.5	35.1	0.0	69.0	0.00	69.0	1.97	2.65	2	Sd gy vf-fgr sslty mica no stn no flor
67	4715.5	5782.7	35.6	0.0	46.3	0.00	46.3	1.87	2.65	2	Sd gy vf-fgr sslty smica no stn no flor
68	4716.5	2563.8	35.6	0.0	51.3	0.00	51.3	1.89	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
69	4717.5	1436.5	38.3	0.0	84.0	0.00	84.0	1.96	2.65	2	Sd gy vf-fgr sslty-slty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
70	4718.5	1611.3	34.2	0.0	56.7	0.00	56.7	1.91	2.61	2	Sd gy vf-mgr sslty-slty smica no stn no flor
71	4719.5	614.5	37.2	0.0	86.3	0.00	86.3	1.99	2.66	2	Sd gy vf-fgr slty smica no stn no flor
72	4720.5	1406.5	36.6	0.0	75.1	0.00	75.1	1.96	2.65	2	Sd gy vf-fgr sslty-slty smica no stn no flor
73	4721.5	6250.2	35.8	0.0	49.7	0.00	49.7	1.88	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
74	4722.5	6945.7	34.5	0.0	44.7	0.00	44.7	1.89	2.64	2	Sd gy vf-mgr sslty smica no stn no flor
75	4723.5	5914.8	35.5	0.0	44.4	0.00	44.4	1.87	2.65	2	Sd gy vf-mgr sslty smica no stn no flor
76	4724.5	5487.2	37.0	0.0	40.8	0.00	40.8	1.82	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
77	4725.5	5295.6	36.6	0.0	58.4	0.00	58.4	1.89	2.64	2	Sd gy vf-mgr sslty smica no stn no flor
78	4726.5	5523.0	34.7	0.0	67.7	0.00	67.7	1.97	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
79	4727.5	2694.3	35.2	0.0	78.4	0.00	78.4	2.00	2.65	2	Sd gy vf-fgr sslty smica no stn no flor
80	4728.7	321.1	35.0	0.0	79.8	0.00	79.8	2.01	2.65	2	Sd gy vf-fgr slty mica carb no stn no flor
81	4729.5	4954.6	37.1	0.0	65.7	0.00	65.7	1.91	2.65	2	Sd gy vf-fgr sslty smica no stn no flor
82	4730.5	7013.3	37.7	0.0	49.4	0.00	49.4	1.84	2.64	2	Sd gy vf-fgr sslty smica no stn no flor
83	4731.5	6371.3	34.7	0.0	60.6	0.00	60.6	1.93	2.64	2	Sd gy vf-mgr sslty smica no stn no flor
84	4732.4	10489.5	37.0	0.0	47.5	0.00	47.5	1.86	2.66	2	Sd gy vf-mgr sslty smica no stn no flor
85	4733.5	2972.2	36.1	0.0	71.0	0.00	71.0	1.96	2.67	2	Sd gy vf-mgr sslty mica scalc no stn no flor
86	4734.5	3602.0	34.3	0.0	37.3	0.00	37.3	1.88	2.67	2	Sd gy vf-fgr/cgr sslty smica no stn no flor
87	4735.5	5546.8	36.1	0.0	37.8	0.00	37.8	1.84	2.67	2	Sd gy vf-mgr sslty smica no stn no flor
88	4736.5	6181.2	35.1	0.0	38.5	0.00	38.5	1.87	2.66	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
89	4737.5	9325.6	34.8	0.0	38.4	0.00	38.4	1.87	2.66	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
90	4738.5	6017.6	38.7	0.0	36.7	0.00	36.7	1.78	2.67	2	Sd gy vf-fgr sslty mica no stn no flor
91	4739.5	6321.3	37.3	0.0	38.0	0.00	38.0	1.82	2.67	2	Sd gy vf-fgr sslty mica no stn no flor
92	4740.5	2573.1	36.4	0.0	87.4	0.00	87.4	2.03	2.68	2	Sd gy vf-fgr/cgr sslty mica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
93	4741.5	8.4	33.3	0.0	95.9	0.00	95.9	2.12	2.69	2	Sd gy vfgr vslty cly mica no stn no flor
94	4742.6	3904.3	35.6	0.0	86.1	0.00	86.1	2.03	2.67	2	Sd gy vf-mgr sslty smica no stn no flor
95	4743.5	7.1	34.0	0.0	92.9	0.00	92.9	2.09	2.69	2	Sd gy vfgr vslty cly mica no stn no flor
96	4744.5	12157.0	33.4	0.0	53.5	0.00	53.5	1.95	2.65	2	Sd gy vf-mgr/gran sslty smica no stn no flor
97	4745.4	12356.4	34.1	0.0	59.7	0.00	59.7	1.96	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
98	4746.5	7356.8	32.6	0.0	65.7	0.00	65.7	2.01	2.66	2	Sd gy vf-vcgr sslty smica no stn no flor
99	4747.5	10126.7	33.3	0.0	60.5	0.00	60.5	1.97	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
100	4748.6	2834.7	34.5	0.0	45.7	0.00	45.7	1.90	2.65	2	Sd gy vf-mgr/vcgr sslty smica (resin contaminated) no stn no flo
101	4749.5	19097.6	34.5	0.0	59.5	0.00	59.5	1.95	2.66	2	Sd gy vf-vcgr sslty smica no stn no flor
102	4750.5	11525.9	32.5	0.0	65.3	0.00	65.3	2.01	2.65	2	Sd gy vf-mgr/gran sslty smica no stn no flor
103	4751.5	13516.7	33.5	0.0	59.8	0.00	59.8	1.97	2.66	2	Sd gy vf-vcgr sslty smica no stn no flor
104	4752.5	20638.0	35.8	0.0	28.8	0.00	28.8	1.81	2.66	2	Sd gy vf-vcgr sslty smica no stn no flor
105	4753.5	19057.5	34.7	0.0	26.2	0.00	26.2	1.83	2.66	2	Sd gy vf-mgr/pbly sslty smica no stn no flor
106	4754.5	8865.0	32.3	0.0	76.5	0.00	76.5	2.05	2.66	2	Sd gy vf-mgr/gran sslty smica no stn no flor
107	4755.5	6610.0	30.7	0.0	78.1	0.00	78.1	2.09	2.66	2	Sd gy vf-mgr/gran sslty smica no stn no flor
108	4756.5	9007.4	31.9	0.0	39.4	0.00	39.4	1.93	2.64	2	Sd gy vf-mgr/gran sslty smica no stn no flor
109	4757.5	19466.8	32.8	0.0	32.7	0.00	32.7	1.88	2.64	2	Sd gy vf-mgr/gran sslty smica no stn no flor
110	4758.8	22297.6	34.0	0.0	40.1	0.00	40.1	1.88	2.64	2	Sd gy vf-mgr/gran sslty smica no stn no flor
111	4759.5	9362.7	33.4	0.0	41.6	0.00	41.6	1.91	2.65	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
112	4760.5	4489.1	29.8	0.0	90.7	0.00	90.7	2.13	2.64	2	Sd gy vf-vcgr sslty smica no stn no flor
113	4761.5	7643.7	31.4	0.0	81.5	0.00	81.5	2.07	2.64	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor
114	4762.5	3968.3	29.4	0.0	82.4	0.00	82.4	2.11	2.65	2	Sd gy vf-mgr/gran sslty vslty lam smica no stn no flor
115	4763.5	6578.2	29.2	0.0	80.4	0.00	80.4	2.11	2.64	2	Sd gy vf-vcgr sslty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Conventional Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Porosity %	Fluid Saturation				Bulk Den g/cc	Grain Den g/cc	Mthd	Description
				Oil %	Water %	O/W Ratio	Total %				
116	4764.5	3076.8	29.1	0.0	80.8	0.00	80.8	2.11	2.64	2	Sd gy vf-mgr/vcgr sslty smica no stn no flor

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
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Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Humidity Controlled Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Routine POR %	Humid POR %	Routine So %	Humid So %	Routine Sw %	Humid Sw %	Routine GD g/cc	Humid GD g/cc	Wt Ratio Hum/Dry Ratio	Clay Factor %
1	4649.5 F/	46.1	29.6	25.4	0.0	0.0	96.6	96.0	2.70	2.60	1.022	22.2
2	4650.5	1.3	29.8	25.2	0.0	0.0	99.4	99.2	2.70	2.60	1.025	24.5
3	4651.5 F/	52.5	28.6	23.7	0.0	0.0	98.8	98.5	2.70	2.59	1.025	25.3
4	4652.5	5.9	28.9	24.3	0.0	0.0	99.8	99.8	2.70	2.60	1.024	23.8
5	4653.5 F/	52.3	32.2	27.5	0.0	0.0	98.4	98.1	2.71	2.60	1.025	25.3
6	4654.5 F/	75.6	32.8	27.9	0.0	0.0	99.8	99.8	2.70	2.59	1.027	27.2
7	4655.5 F/	168.3	34.6	29.1	0.0	0.0	99.1	99.0	2.70	2.56	1.032	31.5
8	4656.5	3.2	32.3	27.7	0.0	0.0	98.5	98.2	2.71	2.60	1.025	25.0
9	4657.5 F/	121.2	32.5	27.8	0.0	0.0	92.6	91.3	2.70	2.59	1.025	25.4
10	4658.5 F/	204.0	35.0	29.6	0.0	0.0	92.1	90.7	2.71	2.58	1.030	30.5
11	4659.5 F/	349.1	33.7	28.1	0.0	0.0	99.6	99.5	2.70	2.57	1.031	31.2
12	4660.5 F/	242.1	33.6	28.2	0.0	0.0	99.5	99.4	2.70	2.57	1.030	30.3
13	4661.5 F/	561.4	33.7	28.4	0.0	0.0	97.7	97.2	2.69	2.57	1.030	29.7
14	4662.5 F/	149.6	33.2	27.7	0.0	0.0	99.1	99.0	2.71	2.58	1.030	30.1
15	4663.5 F/	486.6	32.5	27.8	0.0	0.0	98.3	98.0	2.70	2.59	1.026	25.9
16	4664.5 F/	148.5	32.6	28.0	0.0	0.0	99.5	99.4	2.70	2.59	1.025	25.1
17	4665.5 F/	237.1	32.8	27.5	0.0	0.0	99.4	99.3	2.71	2.59	1.029	28.7
18	4666.5 F/	250.4	34.1	28.7	0.0	0.0	99.9	99.8	2.71	2.58	1.030	30.2
19	4667.5 F/	78.8	32.1	27.4	0.0	0.0	92.9	91.7	2.71	2.60	1.025	25.4
20	4668.5	0.92	28.9	24.0	0.0	0.0	99.6	99.5	2.72	2.61	1.025	25.5
21	4669.5 F/	12.3	32.1	27.1	0.0	0.0	99.9	99.8	2.69	2.57	1.027	27.4
22	4670.5	0.19	33.6	29.1	0.0	0.0	99.7	99.7	2.75	2.64	1.025	24.7
23	4671.5	1.4	35.8	31.1	0.0	0.0	99.5	99.4	2.76	2.64	1.027	26.5

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Humidity Controlled Core Analysis Results

Sample Number	Depth ft		Perm. Kair md	Routine POR %	Humid POR %	Routine So %	Humid So %	Routine Sw %	Humid Sw %	Routine GD g/cc	Humid GD g/cc	Wt Ratio Hum/Dry Ratio	Clay Factor %
24	4672.5		0.14	31.6	26.2	0.0	0.0	99.3	99.1	2.75	2.62	1.029	28.9
25	4673.5		0.32	29.5	24.4	0.0	0.0	98.3	97.9	2.72	2.60	1.027	26.7
26	4674.5	F/	26.9	32.0	26.6	0.0	0.0	98.1	97.7	2.71	2.59	1.029	29.3
27	4675.5		1.3	28.7	22.8	0.0	0.0	98.5	98.2	2.75	2.61	1.030	30.3
28	4676.5		0.31	30.3	24.6	0.0	0.0	99.0	98.7	2.77	2.63	1.030	29.5
29	4677.5		1.0	29.2	23.6	0.0	0.0	96.0	95.0	2.81	2.68	1.028	28.4
30	4678.5		2.5	26.5	21.6	0.0	0.0	93.9	92.5	2.78	2.67	1.024	23.9
31	4679.5		12.1	34.8	32.2	0.0	0.0	89.6	88.7	2.79	2.72	1.014	14.3
32	4680.5		116.2	28.5	27.2	0.0	0.0	86.6	85.9	2.69	2.66	1.007	6.9
33	4681.5		340.4	31.3	30.4	0.0	0.0	81.2	80.6	2.68	2.66	1.005	4.8
34	4682.5		4797.0	37.7	37.4	0.0	0.0	71.2	71.0	2.65	2.64	1.002	1.7
35	4683.5		10019.7	37.3	37.2	0.0	0.0	47.5	47.3	2.64	2.64	1.001	0.7
36	4684.5		2838.9	37.3	36.9	0.0	0.0	67.1	66.8	2.66	2.65	1.003	2.6
37	4685.5		2771.1	35.9	35.8	0.0	0.0	59.6	59.4	2.64	2.64	1.001	0.9
38	4686.5		5291.6	34.2	34.1	0.0	0.0	52.4	52.2	2.65	2.65	1.001	1.1
39	4687.5		4957.9	35.3	35.1	0.0	0.0	52.7	52.5	2.65	2.65	1.001	1.0
40	4688.5		5397.6	35.8	35.6	0.0	0.0	53.3	53.0	2.65	2.64	1.001	0.9
41	4689.5		2782.2	35.2	34.9	0.0	0.0	57.6	57.3	2.65	2.64	1.002	1.6
42	4690.5		4194.5	36.2	36.0	0.0	0.0	54.3	53.9	2.65	2.64	1.002	1.6
43	4691.5		6.6	31.0	27.7	0.0	0.0	91.1	90.0	2.67	2.59	1.018	18.3
44	4692.5		267.0	32.8	31.8	0.0	0.0	87.0	86.6	2.69	2.66	1.006	5.6
45	4693.5		3900.0	35.4	35.3	0.0	0.0	84.8	84.7	2.62	2.62	1.001	1.0
46	4694.5		5309.3	34.3	34.2	0.0	0.0	82.9	82.8	2.64	2.64	1.001	0.9

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Humidity Controlled Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Routine POR %	Humid POR %	Routine So %	Humid So %	Routine Sw %	Humid Sw %	Routine GD g/cc	Humid GD g/cc	Wt Ratio Hum/Dry Ratio	Clay Factor %
47	4695.5	6793.8	34.0	33.8	0.0	0.0	79.6	79.4	2.64	2.64	1.001	1.3
48	4696.5	14179.6	34.4	34.3	0.0	0.0	26.7	26.4	2.64	2.64	1.001	0.9
49	4697.5	14194.9	32.7	32.7	0.0	0.0	26.2	26.1	2.64	2.64	1.000	0.3
50	4698.5	3043.1	30.9	30.5	0.0	0.0	55.8	55.3	2.66	2.65	1.002	1.8
51	4699.5	65.3	30.4	27.9	0.0	0.0	98.0	97.8	2.67	2.61	1.014	13.6
52	4700.5	1184.3	35.6	34.7	0.0	0.0	72.4	71.7	2.67	2.64	1.006	5.6
53	4701.6	2449.6	32.3	31.4	0.0	0.0	66.0	65.1	2.66	2.64	1.005	4.8
54	4702.5	8555.4	38.3	38.1	0.0	0.0	52.5	52.2	2.65	2.65	1.001	1.0
55	4703.3	9104.6	36.5	36.4	0.0	0.0	48.3	48.2	2.66	2.65	1.001	0.7
56	4704.5	6194.1	36.2	36.1	0.0	0.0	76.0	75.9	2.65	2.65	1.001	1.0
57	4705.5	10074.9	35.7	35.6	0.0	0.0	65.8	65.7	2.65	2.65	1.001	0.6
58	4706.5	10882.2	35.3	35.1	0.0	0.0	77.3	77.1	2.65	2.64	1.001	1.3
59	4707.5	8250.2	35.9	35.8	0.0	0.0	73.9	73.8	2.65	2.65	1.001	0.9
60	4708.5	10015.5	35.4	35.4	0.0	0.0	45.8	45.7	2.64	2.64	1.000	0.3
61	4709.5	5523.9	33.3	33.1	0.0	0.0	56.7	56.4	2.66	2.65	1.001	1.2
62	4710.6	3452.5	34.6	34.0	0.0	0.0	77.6	77.2	2.66	2.65	1.003	3.1
63	4711.6	8007.3	32.7	32.3	0.0	0.0	51.3	50.8	2.65	2.65	1.002	1.9
64	4712.5	3809.1	31.0	30.1	0.0	0.0	73.5	72.7	2.65	2.62	1.005	5.3
65	4713.5 F/	116.8	29.6	27.3	0.0	0.0	83.7	82.3	2.70	2.64	1.012	12.5
66	4714.5	2115.5	35.1	34.3	0.0	0.0	69.0	68.3	2.65	2.63	1.004	4.3
67	4715.5	5782.7	35.6	35.5	0.0	0.0	46.3	46.1	2.65	2.65	1.001	0.8
68	4716.5	2563.8	35.6	35.4	0.0	0.0	51.3	51.1	2.64	2.64	1.001	0.7
69	4717.5	1436.5	38.3	38.0	0.0	0.0	84.0	83.9	2.65	2.64	1.002	2.0

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Humidity Controlled Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Routine POR %	Humid POR %	Routine So %	Humid So %	Routine Sw %	Humid Sw %	Routine GD g/cc	Humid GD g/cc	Wt Ratio Hum/Dry Ratio	Clay Factor %
70	4718.5	1611.3	34.2	33.9	0.0	0.0	56.7	56.4	2.61	2.60	1.001	1.5
71	4719.5	614.5	37.2	36.7	0.0	0.0	86.3	86.1	2.66	2.65	1.003	2.6
72	4720.5	1406.5	36.6	36.3	0.0	0.0	75.1	74.9	2.65	2.64	1.002	2.0
73	4721.5	6250.2	35.8	35.7	0.0	0.0	49.7	49.5	2.64	2.64	1.001	0.9
74	4722.5	6945.7	34.5	34.3	0.0	0.0	44.7	44.4	2.64	2.64	1.001	1.1
75	4723.5	5914.8	35.5	35.3	0.0	0.0	44.4	44.2	2.65	2.64	1.001	0.9
76	4724.5	5487.2	37.0	36.8	0.0	0.0	40.8	40.5	2.64	2.64	1.001	1.3
77	4725.5	5295.6	36.6	36.4	0.0	0.0	58.4	58.1	2.64	2.64	1.001	1.2
78	4726.5	5523.0	34.7	34.5	0.0	0.0	67.7	67.6	2.65	2.65	1.001	0.7
79	4727.5	2694.3	35.2	34.9	0.0	0.0	78.4	78.2	2.65	2.64	1.002	1.9
80	4728.7	321.1	35.0	34.2	0.0	0.0	79.8	79.3	2.65	2.63	1.005	4.8
81	4729.5	4954.6	37.1	36.9	0.0	0.0	65.7	65.5	2.65	2.64	1.001	1.3
82	4730.5	7013.3	37.7	37.6	0.0	0.0	49.4	49.2	2.64	2.64	1.001	0.9
83	4731.5	6371.3	34.7	34.5	0.0	0.0	60.6	60.3	2.64	2.63	1.001	1.1
84	4732.4	10489.5	37.0	36.9	0.0	0.0	47.5	47.4	2.66	2.66	1.000	0.5
85	4733.5	2972.2	36.1	35.9	0.0	0.0	71.0	70.7	2.67	2.66	1.002	1.6
86	4734.5	3602.0	34.3	34.1	0.0	0.0	37.3	37.0	2.67	2.66	1.001	1.1
87	4735.5	5546.8	36.1	35.9	0.0	0.0	37.8	37.5	2.67	2.66	1.001	1.0
88	4736.5	6181.2	35.1	34.9	0.0	0.0	38.5	38.2	2.66	2.66	1.001	0.8
89	4737.5	9325.6	34.8	34.6	0.0	0.0	38.4	38.0	2.66	2.66	1.001	1.1
90	4738.5	6017.6	38.7	38.4	0.0	0.0	36.7	36.3	2.67	2.66	1.001	1.5
91	4739.5	6321.3	37.3	37.0	0.0	0.0	38.0	37.5	2.67	2.66	1.002	1.9
92	4740.5	2573.1	36.4	35.9	0.0	0.0	87.4	87.2	2.68	2.67	1.003	3.1

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Humidity Controlled Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Routine POR %	Humid POR %	Routine So %	Humid So %	Routine Sw %	Humid Sw %	Routine GD g/cc	Humid GD g/cc	Wt Ratio Hum/Dry Ratio	Clay Factor %
93	4741.5	8.4	33.3	31.4	0.0	0.0	95.9	95.6	2.69	2.65	1.011	10.5
94	4742.6	3904.3	35.6	34.8	0.0	0.0	86.1	85.8	2.67	2.65	1.005	4.8
95	4743.5	7.1	34.0	32.6	0.0	0.0	92.9	92.6	2.69	2.65	1.008	8.0
96	4744.5	12157.0	33.4	33.2	0.0	0.0	53.5	53.3	2.65	2.65	1.001	0.7
97	4745.4	12356.4	34.1	34.0	0.0	0.0	59.7	59.6	2.65	2.65	1.000	0.4
98	4746.5	7356.8	32.6	32.4	0.0	0.0	65.7	65.6	2.66	2.66	1.001	0.6
99	4747.5	10126.7	33.3	33.2	0.0	0.0	60.5	60.5	2.65	2.65	1.000	0.3
100	4748.6	2834.7	34.5	34.0	0.0	0.0	45.7	44.9	2.65	2.64	1.003	3.0
101	4749.5	19097.6	34.5	34.4	0.0	0.0	59.5	59.4	2.66	2.65	1.000	0.4
102	4750.5	11525.9	32.5	32.4	0.0	0.0	65.3	65.2	2.65	2.65	1.000	0.3
103	4751.5	13516.7	33.5	33.5	0.0	0.0	59.8	59.8	2.66	2.66	1.000	0.3
104	4752.5	20638.0	35.8	35.8	0.0	0.0	28.8	28.7	2.66	2.66	1.000	0.3
105	4753.5	19057.5	34.7	34.6	0.0	0.0	26.2	26.0	2.66	2.66	1.000	0.3
106	4754.5	8865.0	32.3	32.2	0.0	0.0	76.5	76.4	2.66	2.65	1.001	0.6
107	4755.5	6610.0	30.7	30.6	0.0	0.0	78.1	78.0	2.66	2.66	1.001	0.6
108	4756.5	9007.4	31.9	31.8	0.0	0.0	39.4	39.2	2.64	2.64	1.001	0.6
109	4757.5	19466.8	32.8	32.8	0.0	0.0	32.7	32.6	2.64	2.64	1.000	0.3
110	4758.8	22297.6	34.0	33.9	0.0	0.0	40.1	39.9	2.64	2.64	1.001	0.6
111	4759.5	9362.7	33.4	33.3	0.0	0.0	41.6	41.3	2.65	2.64	1.001	0.9
112	4760.5	4489.1	29.8	29.5	0.0	0.0	90.7	90.6	2.64	2.64	1.001	1.4
113	4761.5	7643.7	31.4	31.2	0.0	0.0	81.5	81.4	2.64	2.63	1.001	1.1
114	4762.5	3968.3	29.4	29.2	0.0	0.0	82.4	82.2	2.65	2.64	1.001	1.2
115	4763.5	6578.2	29.2	29.0	0.0	0.0	80.4	80.3	2.64	2.64	1.001	1.2

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

Company: Pacific Gas & Electric Co.
Well: Morais 16-2
Field: East Islands

Location: Sec. 16-3N-5E
Elevation: 8' K.B.
Drlg Fluid: LSND

File No.: 57111-113012PG
API No.: 04-077-20737
Date: 5/22/2013

Humidity Controlled Core Analysis Results

Sample Number	Depth ft	Perm. Kair md	Routine POR %	Humid POR %	Routine So %	Humid So %	Routine Sw %	Humid Sw %	Routine GD g/cc	Humid GD g/cc	Wt Ratio Hum/Dry Ratio	Clay Factor %
116	4764.5	3076.8	29.1	28.9	0.0	0.0	80.8	80.6	2.64	2.64	1.001	1.2

For Mthd Definition See Procedures Page
F/ Indicates Visible Fracture(s) Present

ATTACHMENT G-3

Comparison of BHPs between King Island 1-28 and Piacentine 1-27 in Sept 2005 that shows the wells are not in pressure communication

Well	**King Island 1-28**	**Piacentine 1-27**
Source	Well History	DOGGR
Date	9/29/2005	Sep-05
Reported Surface Pressure, psig	**1,840**	**1,500**
Surface Pressure, psia	1,855	1,515
SG =	0.589	0.589
z factor =	0.845	0.861
Avg wellbore Temp, degF =	95	95
Est. Gas Gradient, psi/ft	0.0440	0.0353
Depth, ft (Top Perf)	4,772	4,670
Est. BH Pressure, psia	**2,065**	**1,680**

Equations

z factor = Dranchuk and Abou-Kassem equation of state (www.CheCalc.com)

Gas Gradient (psi/ft) = (0.01875 x Specific Gravity x Pressure) / (z factor x (Temp degF + 460))

Applied Petroleum Reservoir Engineering, Craft and Hawkins, 1959, pg. 25

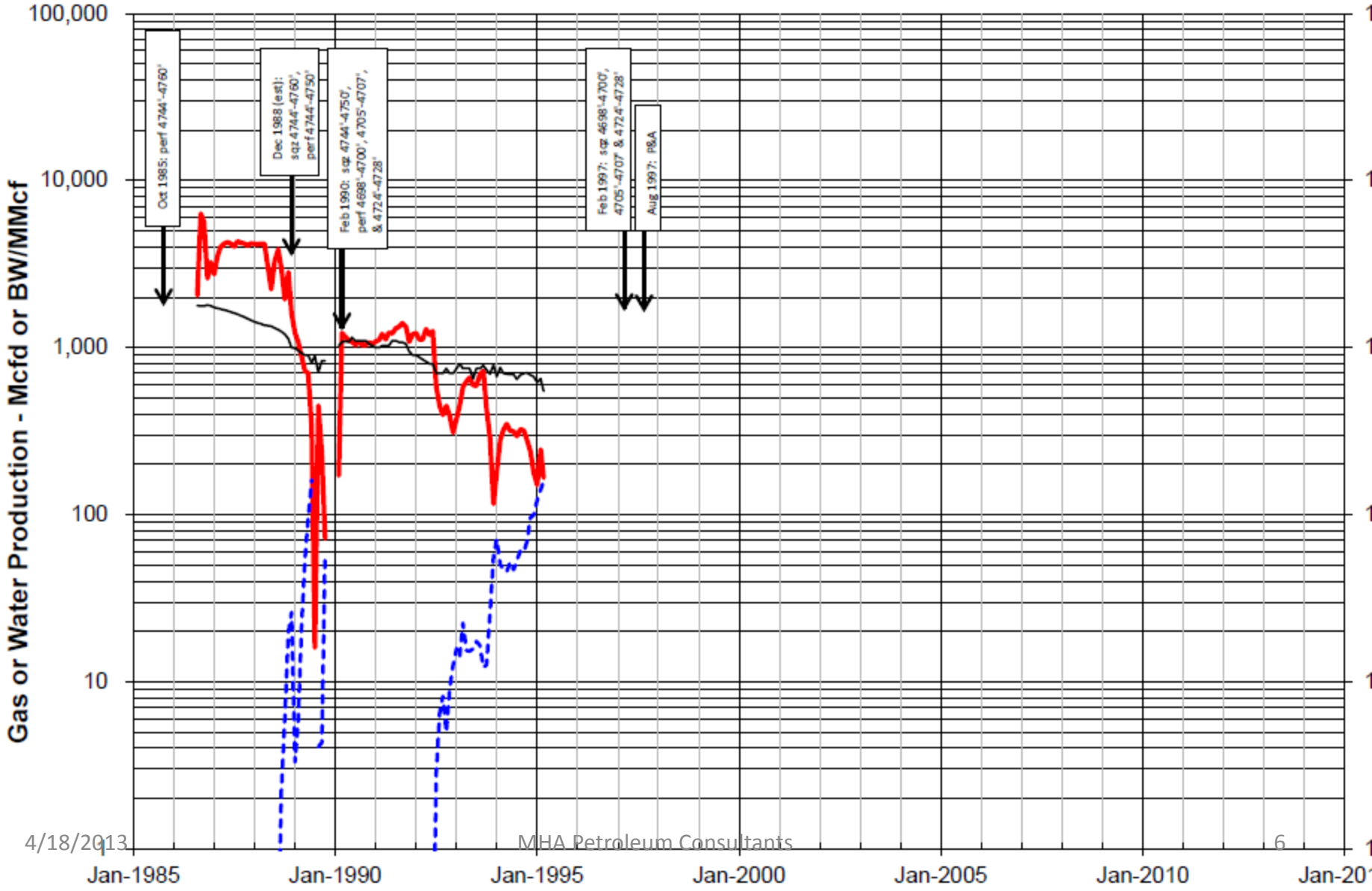
King Island Gas

Gas Composition =	91.72% Methane, 0.13% Ethane, 8.13% Nitrogen, 0.01% CO2	
Specific Gravity =	0.589	
Reservoir Temperature =	120	Deg F
Surface Temperature =	70	Deg F

ATTACHMENT G-4

King Island Gas

Moresco et al Unit A 1 API 07720469



ATTACHMENT H

Operating Data

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Section H.1 Requirements

Section H.2 Injection Rate, Volume and Pressures of Fluids to be Injected

Section H.3 Nature of Annular Fluids

Section H.4 Characteristics of Injection Fluid

Section H.5 References

Table H-1 Summary of Compression Testing Program Phasing and Activities

Table H-2 Overview of Planned Well and Reservoir Performance Tests

Table H-3 Compression Test Operating Conditions

Table H-4 Summary of Gas Chromatography Analysis of King Island Field Gas Sample

Figure H-1 King Island Compression Testing Program

Attachment H-1 Gas Sample Analytical Report

Attachment H-2 Formation Water Sample Analytical Report

H.1 REQUIREMENTS

The operating data to be submitted for all injection wells to be covered under the requested permit includes the following:

- Average and maximum daily rate and volume of the fluids to be injected;
- Average and maximum injection pressure;
- Nature of annular fluid; and
- Source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids.

Because the requested permit will include the proposed monitoring wells also, the above information will also be provided for these wells, to the extent applicable.

H.2 INJECTION RATE, VOLUME AND PRESSURES OF FLUIDS TO BE INJECTED

The proposed compression testing program will involve the injection of oxygen-depleted air[1] over a period of approximately 65 days to build an "air bubble" approximately 500 million standard cubic feet (MMscf) in size and conduct a series of injection, flow and shut in tests while observing the reservoir response. Based on the results of testing with oxygen-depleted air, a short test involving the injection of ambient air may be conducted if certain decision criteria are met, including stringent safety criteria. The total duration of the compression test will not exceed approximately 90 days. The size of the proposed air bubble is between 3 and 4 percent of the estimated original gas in place in the King Island gas reservoir (13.8 BSCF).

The compression testing program is divided into five phases as presented below in Table H-1.

TABLE H-1: SUMMARY OF COMPRESSION TESTING PROGRAM PHASING AND ACTIVITIES

Test Phase		Test Activity	Approximate Duration [1]
1	Bubble Building	Oxygen-depleted air injection	44 days
		Injection fall-off test (FOT)	2 days
2	Bubble Equilibration Period	Shut-in / FOT	2 days
		Multi-rate injection test	1.5 days
		Shut-in / FOT	3 days

[1] A membrane separation system will be incorporated into the air compression train at the surface and used to remove oxygen from the injection stream. The oxygen content of the air will be depleted to approximately to less than 5 percent by volume. The surface equipment used to deliver compressed air to the injection well is further described in Attachment K.

Test Phase		Test Activity	Approximate Duration [1]
3	Withdrawal/Injection Cycle Testing	Well clean-up	4 hours
		Shut-in / Equilibration	2 days
		Isochronal test (flow after flow)	8 hours
		Shut-in / FOT	2 days
		Series 1 oxygen-depleted air injection/ withdrawal/shut-in cycling	3 ½ days
		Shut-in / Equilibration	4 days
		Series 2 oxygen-depleted air injection/ withdrawal/shut-in cycling	3 ½ days
4	Preliminary Data Evaluation and Post-Test Equilibration	Shut in, evaluate data, decision regarding further testing with ambient air (optional)[2]	7 days
5	Additional Testing with Ambient Air	Additional testing using ambient air, if conducted[2]	11 days

Notes:
1. Actual durations of the test phases may change somewhat based on the equipment mobilized and equipment performance under field conditions.
2. The reservoir will be blown down during Phase 4 and after Phase 5 to decrease pressures and the volume of the air bubble to the extent it is feasible to do so.

Reservoir and well performance tests will be performed during the compression test. The purpose of the tests is to evaluate both Injection/Withdrawal Well and reservoir performance properties. The timing of the tests during the compression testing program schedule is shown on Figure H-1. The well performance tests are described in Table H-3.

TABLE H-2: OVERVIEW OF PLANNED WELL AND RESERVOIR PERFORMANCE TESTS

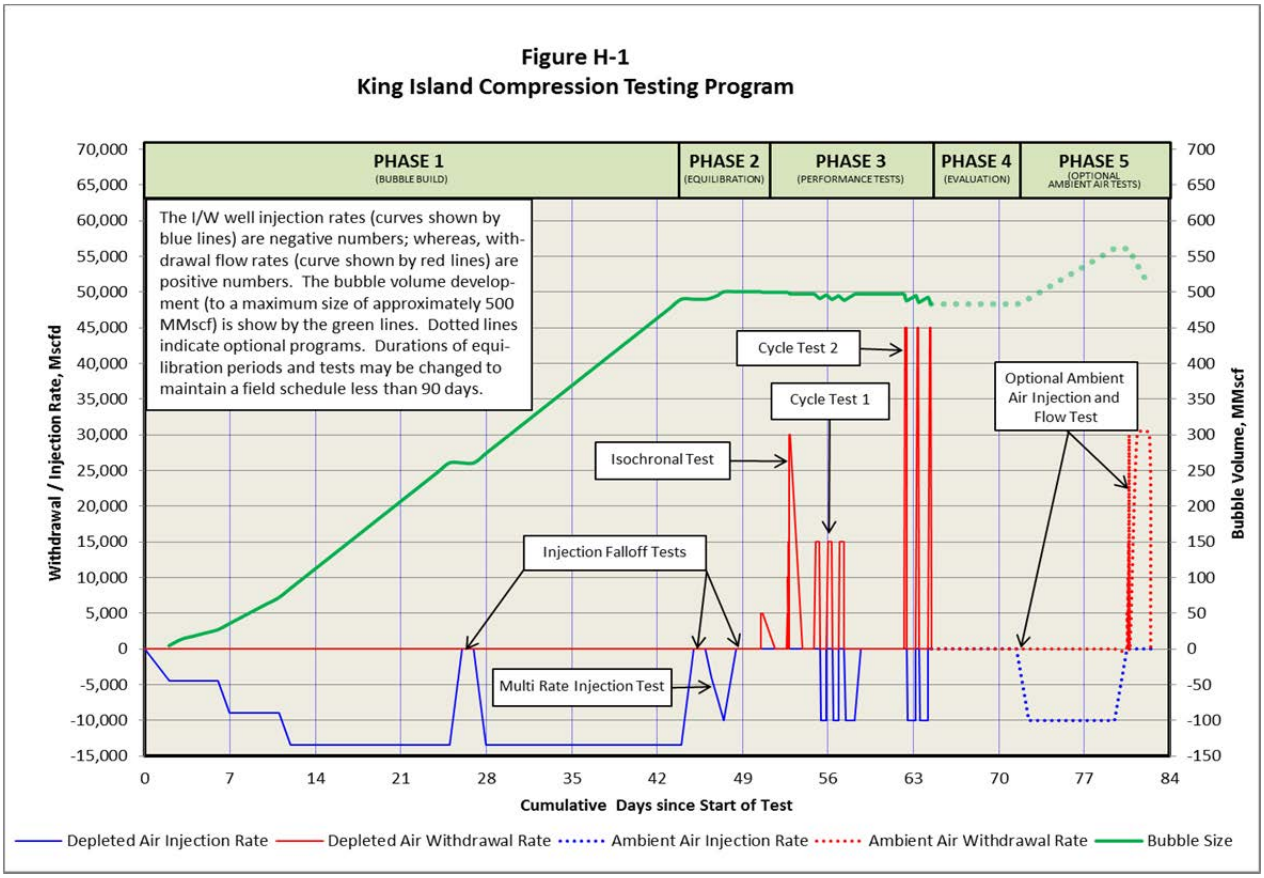
Type of Test	No. of Individual Tests	Description	Estimated Duration per Test	Objectives
Injectivity/Falloff Test (FOT)	3	Extended injection period (bubble building) followed by short shut-in period	48 to 72 hours shut-in after injection	Determine formation permeability, skin damage, reservoir pressure, boundary effects (air-water contact) and bubble size.
Multi-rate Injection Flow Test	1	Increasing rates of 4, 7 and 10 MMscfd for 10 to 12 hours each	Up to 36 hours	Determine air injection flow potential and wellbore effects (friction)

Type of Test	No. of Individual Tests	Description	Estimated Duration per Test	Objectives
Isochronal Test	1	Flow after flow with increasing rates (4 rates x 1 hour each) up to 45 MMscfd	<1 day	Determine air flow potential, absolute open flow, skin damage and rate dependent skin
Interference Tests	2	Monitor pressure response in monitoring well (1-27) to long term injection rate changes in I/W well	12 hours after rate change	Determine formation continuity, areal average transmissivity and storativity
Injection/ Flow Cycle Tests	2 or 3 [1]	Monitor pressure response, water production and native gas production during repeated injection and withdrawal cycles	3-4 days	Determine reservoir response to simulated short term CAES operation, especially in terms of native gas production

Notes:
MMscfd = million standard cubic feet per day
1. An additional injection and flow test using ambient air may be conducted after completing testing with oxygen-depleted air.

A graph depicting the scheduled phases of the compression testing program and anticipated injection and flow rates is provided below in Figure H-1.

Figure H-1
King Island Compression Testing Program



Operating pressures and flow rates for the compression test program are in summarized in Table H-3, below.

TABLE H-3: COMPRESSION TEST OPERATING CONDITIONS

Operating Parameter	Measurement Location	Approximate Value
Maximum injection pressure	Well head	2,200 psig[1]
Minimum injection pressure	Well head	1,650 psig
Maximum injection pressure	Bottom hole	2,500 psia
Maximum injection flow rate	I/W well manifold	14 MMscfd
Minimum injection flow rate	I/W well manifold	4 MMscfd

Notes:
psig = pounds per square inch gauge
psia = pounds per square inch absolute
I/W = Injection/Withdrawal
MMscfd = million standard cubic feet per day
1. The maximum well head injection pressure will be set as a high pressure limit in the operating control system that cannot be exceeded.

The maximum bottom-hole injection pressure during operation of the proposed Injection/Withdrawal Well will not exceed 2,500 psi (2,200 psi wellhead pressure). This pressure will be maintained using a high pressure shut down interlock connected to the wellhead pressure sensor and incorporated into the operating control system for the injection equipment, as described in Attachment K. This maximum pressure is expected to be well below the formation parting pressure. Actual injection pressures are expected to be closer to 2,350 to 2,465 psig as determined by injection modeling.[2]

EPA requires that the Maximum Available Injection Pressure (MAIP) for an injection well be based on the verified pressure gradient minus a factor of safety, usually at least 10 percent. To that end, a step rate test will be conducted as described in Attachment I. According to the available literature, breakdown pressures measured during squeeze cementing operations may be considered as a guideline to estimate the fracture gradient until site-specific data are available. The reported breakdown pressure gradient for wells in the San Joaquin Valley between depths of 3,000 and 5,000 feet is 0.70 psi/ft (California Department of Conservation Division of Oil and Gas, 1984). A fracture gradient of 0.67 psi/foot, or approximately 3,150 psi at a depth of 4,700 feet at the proposed Injection/Withdrawal Well, was therefore estimated to be consistent with the MAIP for the Injection/Withdrawal Well, and is considered a reasonable preliminary estimate of the minimum fracture gradient. Therefore, the proposed maximum injection pressure is below the anticipated MAIP at the site.

[2] Predicted maximum bottomhole pressures for the realistic conservative case (Sh/Kl) described in Attachment A are approximately 2,465 psi.

The average bottom-hole pressure will climb steadily during the test to approximately 2,350 to 2,465 psi, with the maximum being achieved when the air bubble achieves its maximum size. Pressures during the start of injection may also be near the upper end of this range as pore water is initially displaced from the area immediately surrounding the well; however, this will be mitigated by using lower injection rates during the initial bubble building period.

The average injection rate will be approximately 14 MMscfd during bubble building, and 10 MMscfd during subsequent testing, including testing with ambient air, if conducted.

After completion of the compression test, the proposed Injection/Withdrawal Well will be shut in and will not be utilized for injection or flow without first notifying the United States Environmental Protection Agency (EPA). The air bubble left in place in the reservoir will be no greater than approximately 0.5 Bscf. The actual volume will depend on how much air is vented during Phase 4 and 5 of the compression test. If the well will be utilized in the future for injection as part of the proposed CAES program, a separate Underground Injection Control (UIC) permit application will be submitted to cover this future use.

H.3 NATURE OF ANNULAR FLUIDS

In order to protect the Injection/Withdrawal Well and Piacentine 1-27 monitoring well from potential migration of formation fluids up the well bore, and provide an additional protection against the possible intrusion of formation fluids, air, or withdrawn air mixed with formation water and natural gas into Underground Sources of Drinking Water (USDW), the annulus of these wells will be isolated using a tubing and packer system and filled with a water solution containing 4 % KCl mixed with a corrosion inhibitor and a biocide. The annular fluids in these wells will be kept pressurized to near 100 psi by injecting a nitrogen blanket in the uppermost portion of the annulus. Note that annular pressures in the Injection/Withdrawal Well may change as a result of temperature changes during injection and withdrawal of hot air. Annular pressure-temperature changes will be evaluated to verify whether they are due to thermal effects or represent a well failure. The expected magnitude of potential pressure changes due to thermal effects will be calculated prior to the beginning of injection operations and further evaluated early during the injection process. If necessary, the annular pressure will be maintained by pumping additional pressurized nitrogen into the headspace above the annular fluid, or by bleeding off nitrogen. Such adjustments and the resulting pressure changes will be recorded.

In order to distinguish annular pressure-temperature changes due to thermal effects versus well failure, the following is considered. The well annulus will be a closed system, monitored for pressure at the wellhead. As such, the nitrogen blanket on the annular fluid will behave according to Boyles Law and changes in pressure due to thermal effects can be estimated as follows:

$$\frac{P1 \times V1}{T1} = \frac{P2 \times V2}{T2}$$

Where P is pressure measured in psi(atmospheric), or psia, and T is measured in degrees Rankin

For example, with 4,500' of fluid in the annulus and 100' of nitrogen blanket, a temperature increase of 40 degrees Fahrenheit in the entire system would increase an initial wellhead pressure of 100 psia to 136 psia. This is caused by two changes in the system: the increased temperature increases the volume of the fluid slightly, and the volume of the nitrogen blanket is compressed in addition to responding to direct temperature effects. A smaller nitrogen blanket would experience a proportionately larger pressure increase.

Normal fluctuations in pressure, both up and down, are expected to occur to the annulus pressure during injection and withdrawal operations due to changes in the temperature. The normal range of these fluctuations can be estimated based on the information available at the time that the annulus is filled with fluid. A leak, however, changes the relatively fixed volume of fluid in the annulus and as a result the wellhead pressures will trend down over time. While still fluctuating somewhat due to thermal effects, in the event of a leak, pressures would never return to the previous equilibrium pressure. It is the long term trend, not the short term pressure fluctuations that would indicate an issue with the integrity of the casing, tubing, or possibly a leaking tubing packer. Therefore, annular pressure measurements will be evaluated for trends that indicate a loss of fluid volume. If such a trend is identified, it would be reported to EPA within 24 hours and further investigation would be required to determine the exact cause of the annular pressure decrease.

H.4 CHARACTERISTICS OF INJECTION FLUIDS

The medium injected into the depleted gas reservoir at King Island will be air with its oxygen content depleted to a molar concentration of approximately 5 %. This depleted air will consist of the following components:

- 94 mole % nitrogen;
- 5 mole % oxygen;
- 1 mole % argon; and
- Traces of carbon dioxide and other gases.

If a decision is made to conduct injection/withdrawal testing using ambient air, the chemical makeup of the injected fluid will be as follows:

- 78 mole % nitrogen;
- 21 mole % oxygen;
- 1 mole % argon; and
- Traces of carbon dioxide and other gases.

Since air is composed mostly of nitrogen, the compressibility of oxygen-depleted air and ambient air is essentially identical. Both gas mixtures are essentially inert to the proposed tubing and well construction materials.

The main difference between the two gas mixtures is the presence of sufficient oxygen in ambient air to allow combustion if a combustible gas is present at a concentration in excess of the lower combustible limit. This is important because even a depleted gas reservoir will contain some residual gas, the injected air will mix with residual gas in the reservoir to some extent, and if air is produced from the reservoir it will contain a small amount of natural gas. Combustion would require three components, known as the three legs of the combustion triangle: fuel, oxygen, and an ignition source. Evaluations conducted for the project indicate that the methane content in the withdrawn air stream during the Phase 3 cycle tests will be very low (less than 0.2% by volume (v/v) at the end of the second cycle test). This is significantly below the lower combustible limit for methane established for the operating conditions of the compression test (4% v/v), and combustion cannot occur. Nevertheless, only oxygen-depleted air will be injected during this phase of testing, thereby eliminating a second leg of the combustion triangle for added safety. In addition, the combustible gas content of the withdrawn air stream will be monitored continuously during testing, and a safety shut down interlock will be triggered to stop withdrawal if the combustible gas concentration reaches 5%. The monitoring and control program for the compression test is discussed in additional detail in Attachment K.

Prior to a decision to proceed with injection testing using ambient air, the data from the tests conducted using oxygen-depleted air will be evaluated to assure that such a test can be conducted safely. On a preliminary basis, it is estimated that the methane concentration in the withdrawn ambient air stream could rise as high as 0.9% by volume, still well below the lower combustible limit. As with the prior tests, the combustible gas concentration in the withdrawn air would be monitored continuously; however, the safety shut down interlock would be triggered if the combustible gas concentration in the withdrawn air stream reaches 2% to provide an additional margin of safety.

The gas fraction of the withdrawal air would consist primarily of methane with very low concentrations of ethane and propane. Although these gases are potentially combustible in high enough concentrations, they are inert with respect to the well casing and tubing materials. Gas chromatography analysis of a King Island Field gas sample showed the following constituents and concentrations. A laboratory data sheet documenting this analysis is included as Attachment H-1.

TABLE H-4: SUMMARY OF GAS CHROMATOGRAPHY ANALYSIS OF KING ISLAND GAS FIELD NATURAL GAS

Component	Concentration
Methane	91.7 %
Ethane	0.129 %
Propane	18.0 ppm
Other VOCs	Not Detected
Nitrogen	8.13 %
Carbon Dioxide	0.0138 %

Flow testing of the proposed Injection/Withdrawal Well is expected to produce a relatively small amount of formation water with the withdrawn air. Total water production may vary, but is estimated to occur at an instantaneous maximum rate less than 100 barrels of water/day, and to produce less than 500 barrels in totality for the compression test. A formation water sample was collected during drilling of an exploratory core well at the site by PG&E in March and April 2013 (Piacentine 2-27) and submitted to Zalco Laboratories in Bakersfield, California for analysis of major anions and cations (with cation/anion balance), silica, total dissolved solids, hardness, alkalinity, Langlier Index, Stiff/Davis Stability Index, total suspended solids and total organic carbon. A complete laboratory analytical report is included as Attachment H-2. No water quality analysis has ever been performed on produced water from either of the production wells (Piacentine 1-27 and Citizen Green 1), and there is no opportunity to obtain a water sample from either of these wells at this time, since the Piacentine 1-27 well is currently shut-in and the Citizen Green 1 well is not producing any water. The well and tubing materials selected for the proposed well design are appropriate to inhibit corrosion from the anticipated produced water during the course of the test.

H.5 REFERENCES

California Department of Conservation Division of Oil and Gas, 1984. Evaluation and Surveillance of Water Injection Projects. Publication No. M13, pages 11-12.

Analysis

Date-Time: 01/17/13 16:08 Analysis Time: 348 Cycle Time: 360
Stream: 2 Sample 2 Mode: ANLY Cycle Start Time: 16:03
Analyzer: Sacramento Strm Seq:11
Pacific Gas & Electric

Component Name	Mole Percent	BTU Gross	Relative Density
C6+ 50/50/00	0.0000	0.00	0.0000
PROPANE	18.0ppm	0.05	0.0000
i-BUTANE	0.0000	0.00	0.0000
n-BUTANE	0.0000	0.00	0.0000
i-PENTANE	0.0000	0.00	0.0000
n-PENTANE	0.0000	0.00	0.0000
NITROGEN	8.1311	0.00	0.0786
METHANE	91.7241	928.56	0.5081
CARBON DIOXIDE	0.0138	0.00	0.0002
ETHANE	0.1292	2.29	0.0013
TOTALS	100.0000	930.90	0.5883

'*' indicates user-defined components

Compressibility Factor (1/Z) @ 14.73000 PSIA & 60.0 DEG.F= 1.00181

Base Pressures 14.73000

Gross Dry BTU = 932.58 Corrected/Z
Real Relative Density Gas = 0.5891
Unnormalized Mole Percent = 98.691
WOBBE = 1215.04

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Core Lab
RESERVOIR OPTIMIZATION

Petroleum Services

Geochemical Analysis

Pacific Gas and Electric Company

Piacentine 2-27 Well

King Island Field
San Joaquin County, California

FINAL REPORT

April 29, 2013

CL File: 57111-513082PG

Performed by:
Core Laboratories, Inc.
3437 Landco Drive
Bakersfield, California 93308
(661) 325-5657

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations or profitableness, however, of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever.

Petroleum Services Division
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April 29, 2013

Joseph C. Chan
Pacific Gas and Electric Company
6121 Bollinger Canyon Rd., Rm 2510C
San Ramon, CA 94583

Subject: Geochemical Analysis
File No.: 57111-513082PG

Dear Mr. Chan:

Enclosed are final geochemical data for produced water samples submitted to our laboratory from well Piacentine 2-27, King Island Field, San Joaquin County, CA.

Geochemical analysis was performed on a rush basis as requested by PG&E. One water sample was analyzed by Zalco Laboratories, Bakersfield. The remaining two water samples are being held in referigerated storaged pending additional analysis.

Thank you for this opportunity to be of service to Pacific Gas and Electric Company. Please do not hesitate to contact us at (661-325-5657) if you have any questions regarding these results or if we can be of any additional service.

Sincerely,
Core Laboratories

Larry Kunkel
Area Manager - West Coast

Distribution: 1 original report, 1 CD copy: Addressee

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

4309 Armour Avenue
Bakersfield, California 93308

(661) 395-0539
FAX (661) 395-3069

Core Laboratories
3437 Landco Dr
Bakersfield CA 93308

Laboratory No: 1304060-01
Date Received: 4/5/2013
Date Reported: 4/9/2013

Attention: Larry Kunkel

Sample Identification: Chamber 1507
Sampled by: Date: 3/26/2013 Time:
Report Notes:

COMPLETE GEOCHEM ANALYSIS

pH	7.68	Specific Gravity @ 60 F...	1.009
Electrical Conductivity (EC) *(millimhos/cm @ 25 C)*	21.3	Resistivity (ohm meters @ 25 C)	0.4695

Constituents	mg/L	meq/L	Reacting %
Calcium, Ca	430	21	4.72
Magnesium, Mg	130	11	2.35
Sodium, Na	4300	190	41.14
Potassium, K	33	0.84	0.19
Iron, Fe (total)	< 1.0	0	0
Alkalinity as:			
Hydroxide, OH	0	0	0
Carbonate, CO3	0	0	0
Bicarbonate, HCO3	150	2.5	0.54
Chloride, Cl	8200	230	50.86
Sulfate, SO4	42	0.87	0.19
Sulfide, S	< 1.0		
Boron, B	9.6		
Barium, Ba	3.2		
Silica, SiO2	< 40		
Strontium, Sr	15		
Totals (Sum)	13200	456	100

Total Dissolved Solids, (Gravimetric)	14000		
Calculated Hardness, CaCO3	1600		
Total Alkalinity, CaCO3	150		
Sodium Chloride, (total)	13000		
		Primary Salinity	82.66
		Secondary Salinity	14.14
		Total Salinity	96.8
Cation/Anion Balance, %	3.0%		
Sodium, Na (Calculated), mg/L	4635.12	Primary Alkalinity	0
Langelier Scale Index	1.13	Secondary Alkalinity	0
Stiff/Davis Stability Index	1.11	Total Alkalinity	0

Laboratory Authorization

This report is furnished for the exclusive use of our Customer and applies only to the samples tested. Zalco is not responsible for report alteration or detachment.

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

4309 Armour Avenue
Bakersfield, California 93308

(661) 395-0539
FAX (661) 395-3069

Core Laboratories, Inc.	Project: Master	Work Order No.: **1304060**
3437 Landco Drive	Project #: Placentine 2-27	Reported: 04/15/2013
Bakersfield, CA 93308	Attention: Larry Kunkel	Received: 04/05/2013 08:20

Lab Sample ID: **1304060-01**	Collected By:
Client Sample ID: Chamber 1507	Date Collected: 3/26/2013 12:00:00AM

Analyte	Results	PQL		Units	Flag	Method	Date Prepared	Date Analyzed	Init.
Alkalinity									
Total Alkalinity	150	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
Bicarbonate (HCO3)	150	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
Carbonate (CO3)	<10	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
Hydroxide (OH)	<10	10		mg/L		SM 2320B	4/5/13	4/5/13	SAM
General Chemistry			*MCL Limits*						
Fluoride	<1.0	1.0	*2*	mg/L		EPA 300.0	4/5/13	4/5/13	LME
Nitrate as NO3	<20	20	*45*	mg/L		EPA 300.0	4/5/13	4/5/13	LME
Sulfide	<1.0	1.0		mg/L		SM 4500-S F	4/5/13	4/5/13	SS
Total Suspended Solids	32	2.5		mg/L	I-02	SM 2540 D	4/5/13	4/5/13	SAM
Electrical Conductivity	21	0.010		mmhos/cm		SM 2510B	4/5/13	4/5/13	SAM
Nitrite as NO2	<10	10		mg/L	I-02	EPA 353.2	4/5/13	4/5/13	LME
Phosphate (as PO4)	<0.30	0.30		mg/L		SM4500P E	4/5/13	4/5/13	LME
Resistivity	0.4695	0.01000		Ohm-Meters		SM 2510 B	4/9/13	4/9/13	MAC
Ammonium as NH4	13	1.0		mg/L		SM4500NH3D	4/8/13	4/8/13	MSS
Bromide	34	1.0		mg/L		EPA 300.0	4/5/13	4/5/13	LME
Chloride	8200	500		mg/L		EPA 300.0	4/5/13	4/5/13	LME
pH	7.68			pH Units	I-02	EPA 150.1	4/5/13	4/5/13	SAM
Sulfate as SO4	42	5.0		mg/L		EPA 300.0	4/5/13	4/5/13	LME
Total Dissolved Solids	14000	10		mg/L	I-02	SM 2540C	4/5/13	4/5/13	SAM
Hardness									
Hardness (as CaCO3)	1600	2.0		mg/L		SM 2340B	4/5/13	4/5/13	SS
Metals - As Received									
Aluminum	<500	500		ug/L		EPA 200.7	4/5/13	4/15/13	SS
Magnesium	130	0.50		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Potassium	33	5.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Sodium	4600	70		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Calcium	430	0.50		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Iron	<1.0	1.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Boron	9.6	1.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Barium	3.2	1.0		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Copper	<0.50	0.50		mg/L		EPA 200.7	4/5/13	4/5/13	SS
Silica (SiO2)	<40	40		mg/L		EPA 200.7	4/5/13	4/5/13	SS

NSS: Non Sufficient Sample H: Exceeds Analysis Hold Time TTLC: Total Threshold Limit Concentration STLC: Soluble Threshold Limit Concentration TCLP: Toxicity Characteristic Leaching Procedure MCL: Maximum Contaminant Level *: See Case Narrative
The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Note: Samples analyzed for regulatory purposes should be put on ice immediately after sampling and received by the laboratory at temperatures between 0-6°C. Microbiological analysis requires samples to be at least 4-10°C when received at the laboratory. For additional information regarding the limitations of the method(s) referred to, please call us at 661-395-0539.

ZALCO LABORATORIES, INC.
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Core Laboratories, Inc.	Project: Master	Work Order No.: **1304060**
3437 Landco Drive	Project #: Placentine 2-27	Reported: 04/15/2013
Bakersfield, CA 93308	Attention: Larry Kunkel	Received: 04/05/2013 08:20

Lab Sample ID: **1304060-01** Collected By:

Client Sample ID: Chamber 1507 Date Collected: 3/26/2013 12:00:00AM

Analyte	Results	PQL	Units	Flag	Method	Date Prepared	Date Analyzed	Init.
Metals - As Received								
Strontium	15	1.0	mg/L		EPA 200.7	4/5/13	4/5/13	SS
Manganese	<0.30	0.30	mg/L		EPA 200.7	4/5/13	4/5/13	SS
Zinc	<0.50	0.50	mg/L		EPA 200.7	4/5/13	4/15/13	SS
Petroleum Chemistry								
Specific Gravity @ 60/60 °F	1.009				ASTM D 4052	4/9/13	4/9/13	MAC

NSS: Non Sufficient Sample H: Exceeds Analysis Hold Time TTLC: Total Threshold Limit Concentration STLC: Soluble Threshold Limit Concentration TCLP: Toxicity Characteristic Leaching Procedure MCL: Maximum Contaminant Level *: See Case Narrative
The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Note: Samples analyzed for regulatory purposes should be put on ice immediately after sampling and received by the laboratory at temperatures between 0-6°C. Microbiological analysis requires samples to be at least 4-10°C when received at the laboratory. For additional information regarding the limitations of the method(s) referred to, please call us at 661-395-0539.

CAPCO
Analytical Services, Inc.

CERTIFICATE OF ANALYSIS

Client: Zalco
CAS LAB NO: 131138
Analyst: LL

Date Sampled: 03/26/13
Date Received: 04/05/13
Date Analyzed: 04/05/13
Sample Matrix: Water

Total Organic Carbon
Standard Method 5310B

CAS Lab #	Sample ID	RESULTS (mg/L)	Dilution Factor	PQL (mg/L)	MDL (mg/L)
131138-01	1304060-01	21	10	2.0	0.40

QUALITY CONTROL REPORT

130405-MB	Method Blank	ND	1	0.2	0.04

1536 Eastman Ave. Ste B Ventura CA 93003 (805) 644-1095
www.capcoenv.com

ATTACHMENT I

Formation Testing Program

CONTENTS

Section I-1 Requirements

Section I-2 Core Well Formation Properties Testing

Section I-3 Injection/Withdrawal Well Formation Properties Testing

Section I-4 Formation Fluid Testing

Section I-5 Formation Parting Pressure Testing

Section I-6 Fall-Off Pressure Testing

Table I-1 Summary of Geophysical Log Type and Purpose

I.1 REQUIREMENTS

The formation testing program must be designed to obtain data on:

- Fluid pressure;
- Temperature;
- Formation parting pressure and other physical characteristics of the injection zone;
- Physical, chemical, and radiological characteristics of the formation water; and
- Physical, chemical, and radiological characteristics of the injection fluids.

I.2 CORE WELL FORMATION PROPERTIES TESTING

A full range of physical, textural, mineralogical and chemical properties of the target injection zone (Mokelumne River Formation) and overlying confining zone (Capay Shale) have been determined through petrophysical analysis of conventional core, sidewall core, and wireline logs collected from a core-well drilled by PG&E at the King Island Field in March-April 2013 (Piacentine 2-27). The data derived from these efforts to date are included in Attachment C-1 (wireline logs) and Attachment G-1 (core analysis).

During the drilling of PG&E core well Piacentine 2-27, approximately 180 feet of conventional core (4" diameter) were collected from the target injection zone (primarily sands) and overlying confining unit (primarily shale). The core was transported to CoreLab where it was slabbed, photographed, described, and underwent core spectral gamma and CT scanning. Plugs collected at 1-foot intervals from the conventional core, and 22 additional sidewall cores (SWCs), were subjected to the following routine core analyses:

- Grain density;
- Porosity;
- Horizontal permeability to air;
- Fluid saturation (water); and
- V-clay.

The following additional advanced analyses were performed on a number of samples:

- Sieve analysis (15 samples);
- Vertical permeability (15 samples);
- Porosity and permeability at four confining stresses (15 samples);
- Relative permeability (5 samples);

- Critical velocity (3 samples);
- Capillary pressure (6 samples);
- Mercury injection capillary analysis (and with confining pressure) (6 samples);
- Capillary entry pressure (shale only) (3 samples);
- Geomechanical properties, including Poisson's ratio and Young's modulus (3 samples);
- Thick wall cylinder test (3 samples);
- Scanning electron microscopy and thin section analysis (15 samples); and
- Bulk and clay x-ray diffraction (XRD) (15 samples).

In addition to standard mud logging, a comprehensive wireline open hole logging program was conducted during drilling of Piacentine 2-27 to collect information regarding formation matrix and fluid properties. The log types and information derived is summarized in the table below. A downhole thermometer was used to measure the bottom-hole temperature during each logging run, which is reported on the logs.

TABLE I-1: SUMMARY OF GEOPHYSICAL LOG TYPE AND PURPOSE

Log Type	Purpose
Sidewall coring (SWC)	Reservoir parameters. Compare routine core analysis results to those from conventional core and relate to future well SWC results.
Mud Log	Lithology, rate of penetration, gas shows.
Spontaneous Potential (SP) log	Sand layer definition, formation water salinity interpretation.
Dual induction log (DIL)	Formation water salinity, hydrocarbon indicator, water/hydrocarbon saturation (with porosity measurements).
Micro-resistivity Tool (MRT)	Flushed and invaded zone resistivity, permeability indicator.
Gamma Ray (GR) log	Shale indicator. Standard and spectral GR run, which permits more accurate V-shale determination and lithological and mineralogical analysis.
Formation Density Compensated (FDC) log	Porosity measurement, water/hydrocarbon saturation (with resistivity measurements).

Log Type	Purpose
Compensated Neutron Log (CNL)	Porosity measurement, water/hydrocarbon saturation (with resistivity measurements).
Sonic log (SL)	Formation velocity, geomechanical property determination and synthetic seismograms. Can also be used for porosity determination.
Nuclear Magnetic Resonance (NMR) log	Provides porosity divided into clay-bound water, irreducible water, and movable water. Effective porosity derived by subtracting clay-bound water. Permeability measurement.
Caliper log (CAL)	Show variations in borehole size and geometry.
Electrical Micro Imaging (EMI) log	Formation texture, sedimentary features, fractures, thin-bed and lamination characterization.
Repeat Formation Tester (RFT)	Depth-discrete formation water sampling (one sample), formation water resistivity and static reservoir pressure measurement. Characterization of formation pressure above, within and below the reservoir, reservoir water chemistry evaluation.

I.3 INJECTION/WITHDRAWAL WELL FORMATION PROPERTIES TESTING

Given the extensive logging and core analysis program instituted for the core well, it is not considered necessary to collect a conventional core in the proposed Injection/Withdrawal Well, due to its close proximity to the Piacentine 2-27 core-well. However, up to 30 sidewall cores will be collected and tested for routine reservoir parameters in order to verify properties, including the following:

- Lithologic description;
- Grain density;
- Porosity;
- Permeability to air; and
- Fluid saturation (water).

For the same reason, the electric logging program in the Injection/Withdrawal Well will be a subset of the Piacentine 2-27 logging program (in terms of the types of logs run). The electric logging program will include all of the logs noted above, except NMR and EMI. In addition, as further discussed in Section I.4, the RFT tool will be used only to obtain formation pressure measurements, but not to collect water samples. The suite of logs run from the bottom of the conductor casing (60 feet) to the bottom of the surface casing interval (600 feet) will include SP, MRT, GR and CAL. The suite of logs run from 600 feet

to the full depth of the boring will include these logs, and also the DIL, FDC, CNL, SL, RFT, and SWC. Mud logging will be initiated from the bottom of the conductor casing throughout the entire drilling interval. A downhole thermometer will measure the bottom-hole temperature during each wireline logging run.

I.4 FORMATION FLUID TESTING

Formation fluid physical and chemical properties were determined through analysis of an in-situ water sample collected from the Piacentine 2-27 core-well using the RFT tool, and analyzing the sample for total dissolved solids (TDS), conductivity, major anions and cations, hardness, alkalinity, Langlier Index, Stiff/Davis Stability Index, total suspended solids and total organic carbon. The results of this analysis are included as Attachment H-2. The chemistry of the subsurface formation water was further evaluated by electric and neutron-density log interpretation as discussed in Attachment E in order to assess the depth of USDW.

During completion of the proposed Injection/Withdrawal Well, a second formation water quality sample will be collected from the injection horizon during well completion, using coiled tubing and nitrogen to unload the well of drilling fluids and induce formation water flow. Produced water samples will also be collected during operation of the compression test. The initial formation water sample and three produced water samples will be submitted to a certified analytical laboratory to be analyzed as described above. In addition, the electric and neutron-density logs of the Injection/Withdrawal Well will be evaluated to assess the vertical concentration distribution of TDS in the formation water penetrated by the new well, and the results will be used to verify and update the prior analysis as needed.

Further use of the RFT tool to collect formation water samples is not proposed because our experience with formation water sampling using the RFT tool during drilling of the core well indicates that it entails significant risk of tool and borehole loss under the conditions encountered at the King Island gas field during the drilling of the Piacentine 2-27 core well. Only a single water sample was collected. The sample took approximately 4 hours to collect and it was difficult to free the RFT tool after the sample was collected; therefore, further attempts were deemed to be too risky and expensive to proceed. In our opinion, further RFT water sampling is not prudent or warranted in light of the conditions encountered and the relatively robust evaluation that has already been completed.

I.5 FORMATION PARTING PRESSURE TESTING

As discussed in Attachment H, the maximum bottom-hole pressures at the proposed Injection/Withdrawal well are anticipated to be below the Maximum Allowable Injection Pressure (MAIP). Nevertheless, a Step Rate Test (SRT) will be conducted in order to investigate the formation parting pressure. The test will be performed in general conformance with Society of Petroleum Engineers (SPE) Paper 16798, “Systematic Design and Analysis of Step-Rate Tests to Determine Formation Parting Pressure” (Singh et al., 1987). Prior to performing the SRT, a work plan will be

submitted to EPA for review and approval at least 30 days prior to the test. The field schedule will need to be closely coordinated with EPA because the test will be performed with the drill rig on stand-by.

In order to avoid potential damage to the Injection/Withdrawal Well and gravel pack, the test is proposed to be performed in an open borehole prior to final completion of the well. Because the upper reservoir sands are anticipated to be relatively highly permeable, an 8 ¾-inch borehole will be drilled approximately 10 feet into the Mokelumne River Formation reservoir sands, circulated clean, and filled with 4% KCL water. A wireline pressure-temperature gauge with redundant sensors and a surface readout will be lowered 5 feet into the Mokelumne River Formation to record bottom-hole pressures and temperatures during the test. The test will be performed using 4% KCl water injection in rate steps of 2 barrels per minute bpm until the fracture gradient has been established based on a change in slope of the graphed pressure response as specified in the referenced paper. If the fracture pressure cannot be reached within the limitations of feasible injection rates, the maximum pressure response and injection rate will be noted.

The tentative field procedures are presented in detail in the drilling program included as Attachment L-1 and are summarized as follows:

1. An 8 ¾-inch bit will be used to drill to total depth.
2. After completion of logging, the hole will be cemented to approximately 30 feet above the top of the Mokelumne River Formation.
3. A 12 ¼-inch bit will be used to drill out the hole and cement to the top of the Mokelumne River Formation and a 9 5/8-inch casing will be cemented to the top of the Mokelumne River Formation.
4. An 8 ¾-inch bit will be used to drill out the shoe of the 9 5/8-inch casing and drill 10 feet into the Mokelumne River Formation.
5. Open ended drill pipe will be lowered into the hole to the top of the Mokelumne River Formation and the hole will be circulated clean with 4% KCl water.
6. At least 1,000 barrels of clean filtered 4% KCl water will be mobilized to the site and placed in storage tanks near the well site. The weight and viscosity of the fluid will be measured.
7. Before the start of the SRT test, the hole will be filled with 4% KCl water until water levels are stable. Record stabilized bottom hole pressure for 1/2 hour.
8. A pressure-temperature gauge with redundant sensors and surface read out (or duplicate pressure-temperature gauges) will be lowered into the hole and secured approximately at the mid-point of the clean, open 10 foot hole in the Mokelumne River Formation below the 9 5/8-inch casing. The bottomhole pressure will be allowed to stabilize and will be recorded for at least 30 minutes.
9. Two pump trucks will be moved in and connected to the drill pipe.

10. Step rate injection will be conducted using the 4% KCl water. The first step will be conducted at 2 bpm and each subsequent step will be increased at increments of an additional 2 bpm. Constant injection rates will be maintained during each step for a period of 30 minutes.
11. The resulting injection rates and pressures will be plotted and evaluated in accordance with SPE Paper 16798. Additional step rate increases will be implemented until at least two (and preferably three) rates plot past an identified break in slope that indicates the fracture pressure has been reached.
12. If a break in slope is not evident, continue the test as long as feasible, at a minimum until a bottom-hole pressure of at least 3,200 psi has been reached.

I.6 FALL-OFF PRESSURE TESTING

Fall of testing will be conducted in general accordance with the EPA Region 9 Falloff Testing Requirements, dated August 8, 2002. At least 30 days prior to conducting the fall off tests, a brief work plan discussing the procedures and interpretation of the tests will be submitted for EPA for review and approval. The data will be used to verify the reservoir characteristics used to calculate the Zone of Endangering Influence (ZEI) in Attachment A, and to update calculations regarding the ZEI as necessary. The field schedule will need to be closely coordinated with EPA because the test following the SRT will be performed with the drill rig on stand-by, and the tests using air will need to be coordinated with the pilot testing schedule.

A fall-off test (FOT) will be conducted at the end of the step rate test described in Section I.5. If possible, the final step rate will be maintained for up to twice as long as prior steps in order to make the test data easier to interpret. After completion of the step rate test, the well will be shut in, and bottom-hole pressures and temperatures will continue to be recorded for 12 hours to measure the pressure falloff prior to retrieving the wireline pressure-temperature gauge.

Fall-off pressure testing will also be conducted on the Injection/Withdrawal Well using as part of the bubble-building phase of the injection testing program (see Attachment H). The FOTs will provide data to evaluate reservoir transmissibility, permeability (based on formation thickness), skin factor, pressures (well flowing and static), as well as show the completion conditions of the well and the presence of any boundaries reached during the injection period. Bottom-hole pressures during these tests will be measured using the permanent downhole pressure-temperature gauges installed in the Injection/Withdrawal Well (described in Attachment P).

The tests will involve an injection period (producing pressure build-up) long enough to reach radial flow conditions. Likewise, pressure will be monitored during the pressure fall-off period (following pump shut-down) for duration sufficient to reach radial flow conditions and to see the effects of any boundaries reached during the injection period.

I.7 REFERENCES

Singh, P.K., R.G. Agarwal, and L.D. Krase, 1987. Systematic Design and Analysis of Step-Rate Tests to Determine Formation Parting Pressure: Society of Petroleum Engineers Paper 16798.

ATTACHMENT J

Stimulation Program

CONTENTS

Section J-1	Requirements
Section J-2	Description of Stimulation Program
Section J-3	Stimulation Monitoring
Section J-4	Notification and Record Keeping
Attachment J-1	Proposed Stimulation Program

J.1 REQUIREMENTS

Attachment J outline any proposed stimulation program, including the methods and materials used, monitoring, and reporting.

J.2 DESCRIPTION OF STIMULATION PROGRAM

The Injection/Withdrawal Well may require stimulation to establish better connectivity with the reservoir to increase the well injection capacity. This program is optional. If a decision is made that the well would benefit from stimulation, the program will only be implemented once prior to completion of the proposed compression test.

If pressures during initial injection or the well response to initial fall-off testing indicate a lower than anticipated well injectivity, the well may be evaluated for stimulation. The well would be treated using an acid mixture premixed with chelating agent, iron control, clay stabilizer, mutual solvent, and inhibitor to break up residual mud clogging and improve the well interface with the sand formation. Details regarding the proposed program are included as Attachment J-1. Any changes or adjustments to this program would be presented to EPA for review and approval prior to implementation. In addition, EPA would be notified at least 48 hours prior to implementation of any stimulation program.

J.3 STIMULATION MONITORING

During the proposed stimulation program wellhead pressures (tubing and annulus) and injection rate will be continuously recorded on monitoring devices and will be analyzed for indications of leakage between tubing and casing or through the packer, and formation parting pressure exceedance. During the program, the maximum treatment pressure and rate will be based on the results of the step rate test (SRT) so as to remain below the formation parting pressure, with a safety margin. The monitoring devices used during the stimulation program include the following:

- Injection pressures will be monitored continuously using the downhole and wellhead temperature and pressure monitors installed in the Injection/Withdrawal Well described in Attachment K. Temperature and pressure readings will be recorded every 30 seconds.
- The volume and type of stimulating agents and water pumped into the well will be recorded.
- A detailed record of all stimulation activities will be maintained.

J.4 NOTIFICATION AND RECORD KEEPING

A more detailed stimulation plan will be provided to EPA for review and approval at least 30 days prior to implementation, if well stimulation is conducted. If changes are made to the stimulation program, the amended program will be provided to EPA for review and approval at least 30 days prior to implementation.

Treatment records and analysis will be submitted to EPA personnel within 10 days after completing the treatment program.

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SACRAMENTO, CALIFORNIA 95864
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PG&E

King Island Injection/Withdrawal Test Well No. 1

Location: X=1734880.641 Y= 577346.753 (NAD 27, Zone III)
Section 27, T 3N, R 5E, San Joaquin County, California.
Elevation: -3.75' ground. +8.25' KB (NGVD 29)

Take all measurements from KB which is 12' above ground.

Present Condition

TD:~4772' MD PD: ~4767' MD
Casing: 13-3/8", 54.5#, J-55 surface casing cemented at 600
9-5/8", 40#, J-55 & N-80 intermediate casing cemented at 4730'.
5-1/2" premium wire wrap liner gravel packed from 4710' to 4772'.
Tubing: 5-1/2", 15.5#, J-55, LT&C, thread with seal assembly stabbed into SC packer at ~4637'.
Note: A downhole permanent pressure gauge is above the seal assembly. There is ¼" cable that runs outside of tubing and it is affixed to the tubing with 5-1/2" Cross Coupling Cable Protectors at every connection. The cable goes through the outlets in the tubing hanger and tubing head top flange and is connected to an instrument junction box at surface.
Note: There is 4% KCL water in tubing. This well is directional with maximum angle of 20 degrees.

Stimulation Program

1. **Move in 1-1/2" CT Unit. Pressure test CT. Run jet washer nozzle at the end of CT. Set up BOP on production tree. RIH to 4767'. Circulate clean any fill. Hold safety meeting. Equalize 50 Bbl mixture of 10% HCl, 9/1 Mud acid premixed with Chelating Agent, Iron Control, Clay Stabilizer, Mutual Solvent, and Inhibitor from 4767' to 4680' While pulling CT to 4680'. Wait for 3 hours. RIH to 4767'. Pump another 50 bbls of the same acid mixture into formation while reciprocate CT from 4767' to 4680'. Pull CT to 4590'. Circulate with clean injection water. POOH with CT.**

2. **Inject 300 Bbl of clean injection water, record pressure and rate.**

January 1, 2014

ATTACHMENT K

Injection Procedures

CONTENTS

Section K-1 Requirements

Section K-2 Injection/Withdrawal Well Equipment and Process Description

Section K-3 Compression Testing Temporary Site Facilities

Table K-1 Data Acquisition Sensors

Figure K-1 Temporary Site Facility General Arrangement

Figure K-2 Compression Testing Instrumentation Strategy Matrix

Attachment K-1 Process Flow Diagrams

K.1 REQUIREMENTS

Attachment K is to include a description of the injection equipment and procedures.

K.2 INJECTION/WITHDRAWAL WELL EQUIPMENT AND PROCESS DESCRIPTION

Process Flow Diagrams showing the injection and withdrawal air stream and major equipment are included in Attachment K-1. The general arrangement of major surface equipment to support the injection and withdrawal of air from the proposed well is shown on Figure K-1. The design of the compression test facilities is still in progress and some details may therefore change prior to implementation; however, the injection process and major injection equipment will remain as described below and shown in Attachment K-1 and Figure K-1.

The process and equipment used during injection will include the following:

- Air will be drawn into one or two compressor trains consisting of one low pressure, one medium pressure, and three high pressure compressors. Under the current design, the compressors will discharge a maximum pressure of 2,200 pounds per square inch (psig) at a flow rate up to approximately 14 MMscfd. The process flow will be cooled in between compression stages to provide more efficient compression. Power for the compressors will be provided by a temporary electrical connection provided by PG&E.
- The injection stream will consist of nitrogen (greater than 95% N_2) generated using a portable membrane filtration system. The membranes will be placed between the medium and high pressure compressors.
- An aftercooler will cool the compression discharge to a maximum temperature of 140 °F prior to injection.
- Injection flow will be routed through an automated control valve (located on the wellhead), which can be used to shut in the well, if needed, and which will be automatically closed when injection or flow are not occurring, or when a power interruption occurs.
- The air will be injected at the Injection/Withdrawal Well through 5-½ inch tubing with a packer to isolate the injection zone and the casing-tubing annulus.
- Lateral and vertical bubble development will be monitored by performing periodic pulsed neutron logging in the monitoring wells (Piacentine 1-27 and 2-27).
- Pressure, temperature, and oxygen content will be monitored at the Injection/Withdrawal manifold pipe near the wellhead. Injection rate and volume will be monitored on the injection pipe near the compression equipment. System interlocks will be set to automatically shut down injection and shut the well in the event of:
    - Rapid annular pressure changes;

  - Wellhead pressure in excess of 2,200 psig;
  - Rapid wellhead pressure falloff;
  - Out of range temperature (high temperature alarm);
  - Out of range oxygen content; and/or
  - A manual trip

The process equipment used during flow testing will include the following:

- Withdrawal flow will be routed through an automated control valve (located on the wellhead), which can be used to shut in the well, if needed, and which will be automatically closed when injection or flow are not occurring, or when a power interruption occurs.
- Pressure, temperature, and hydrocarbon gas content will be monitored at the Injection/Withdrawal manifold pipe near the wellhead. Flow rate and volume will be monitored on the flow vent pipe near the test separator. System interlocks will be set to automatically shut down withdrawal and shut in the well in the event of:
  - Rapid annular pressure changes;
  - Rapid wellhead pressure falloff;
  - Out of range hydrocarbon vapor concentration (high hydrocarbon concentration alarm);
  - Out of range temperature (high temperature alarm); and/or
  - A manual trip.
- An in-line heater may be used to heat the withdrawn air stream if the operator determines that the device is necessary to maintain temperatures for proper functioning of downstream equipment.
- Withdrawal flow will be controlled through a choke valve to maintain flow and pressure within the desired range during the tests.
- A test-separator will be used to separate produced water from the air stream, as needed. The produced water will be routed to one or more portable 500-barrel water tanks.
- The withdrawal flow will be discharged through a vent stack.

Auxiliary electrical equipment required to support compression and injection operations will include the PG&E temporary electrical supply, step down transformer, and power distribution system. The system will be designed to automatically shut in the well by closing the automated control valve in the event of power interruption or failure. The process equipment, control system, alarm and interlock functions will be designed to applicable process engineering safety standards used in the hydrocarbons industry by the contractor selected to design, build and operate the compression test surface facilities.

K.3 COMPRESSION TESTING TEMPORARY SITE FACILITIES

A conceptual General Arrangement drawing of the proposed surface facilities for the compression test is shown in Figure K-1, and a list of major equipment is provided below.

- Low Pressure and Booster Compressors
    - Air intake filter system
    - Compressor intercoolers/after-coolers
    - Compressor electric drive motor
- Oxygen Depletion Equipment
    - Nitrogen membrane skid
    - Inline Process Heater (for injected air/nitrogen, if determined to be necessary)
- Cooling System
    - Air coolers (if available) or air cooled chillers, including air cooled condensers, fans, evaporators, compressors, controls, and interconnecting piping
    - Chilled water pumps, valves and piping
    - Compressor cooling water pumps, valves and piping
    - Cooling and chilled water makeup treatment system
    - Cooling and chilled water expansion tanks
    - Cooling water heat exchangers
- Withdrawal Testing Equipment
    - Choke manifold or in-line water bath heater with choke (if necessary)
    - Test separator
    - Produced water tanks
    - Withdrawal gas vent
- Wells
    - Injection and withdrawal well
    - monitoring wells
    - Emergency shutdown valves on the wellhead that can be actuated by the control system in the event system interlock thresholds are triggered
    - Christmas tree
- Instrument/Service Air System – Air and Nitrogen Injection Package
    - Air Compressors including coolers
    - Instrument Air Dryer(s)
    - Instrument Air Receiver
    - Service Air Receiver

- Transformers
    - Main Step-down Transformer(s) (Power Supply to MV switchgear)
    - Auxiliary Transformer(s) 4.16 kV-480 V (if required by Air/Nitrogen Injection Package)
    - Auxiliary Transformer(s) 480 V-240/120 V
- Station Switchgear
    - HV and MV Switchgear
    - 4.16 kV Switchgear (if necessary)
    - 480 V Switchgear

The equipment will be deployed on a gravel pad approximately covering 3 contiguous acres. After completion of the test, the equipment will be removed and the Injection Withdrawal Well and monitoring wells will be shut in.

K.4 INSTRUMENTATION AND CONTROL STRATEGY

A graphical representation of the instrumentation strategy for the compression test is presented in Figure K-2. The matrix in this figure provides details for each element of the instrumentation and data acquisition system, including data storage (e.g., centralized data logger), data application (technical, compliance or operations), and data collection (storage frequency, download frequency, and manual data QA/QC "check" frequency). A listing of data acquisition sensors is presented in Table K-1, below. The Process Flow Diagrams in Attachment K-1 show the locations of the sensors and process equipment relative to the major equipment layout.

TABLE K-1: DATA ACQUISITION SENSORS

Monitoring and Measurement Instrumentation Category	Monitoring and Measurement Instrumentation
Downhole and Wellhead Instrumentation	Monitoring well (1-27 and 2-27) pulsed neutron logs (Attachment I)
	Monitoring well (1-27) downhole pressure/temperature (PT) sensors
	Monitoring well (1-27) wellhead PT sensors
	Injection/Withdrawal wellhead PT sensors
	Annular PT sensor
Injection/Withdrawal Well Manifold	Hydrocarbon analyzer
	Oxygen sensor
	Flame sensor
	Gas sampling port
Injection Instrumentation	Temperature-Compensated Orifice Flow Meter
	Compressor train sensor package
	Nitrogen generator sensor package

Monitoring and Measurement Instrumentation Category	Monitoring and Measurement Instrumentation
Flow Instrumentation	Water tank sample port
	Test separator sensor package
	Water tank level sensor
	Temperature-Compensated Orifice Flow Meter
	Vent stack sampling port

A description of the data acquisition strategy is presented below. In this discussion, instrumentation is described based on its location, including: (1) downhole or wellhead instrumentation; (2) instrumentation installed on the shared injection-withdrawal manifold piping near the wellhead of the Injection/Withdrawal Well (the Injection/Withdrawal Well manifold); (3) instrumentation associated with equipment used for nitrogen generation and compression (the injection leg of the surface facilities); and (4) instrumentation associated with the test separator, water tanks or vent stack (the flow leg of the surface facilities). The project proposes to use a single, centralized data acquisition and control system to collect data and provide control functions. That data acquisition and control system will be provided with an uninterruptable power supply, such that compliance and control data can be collected on a continual basis in the event of a power failure or outage.

WELL AND WELLHEAD INSTRUMENTATION

The following downhole and wellhead instrumentation will be utilized:

- Piacentine 1-27 and 2-27 will be utilized as monitoring wells. Gamma Ray (GR), Casing Collar Locator (CCL) and Pulsed Neutron (PN) logs of these wells will be obtained by a logging contractor just before the beginning, at the middle, and at the end of the bubble-building phase to assess the growth of the test bubble over time and compare it to the bubble geometry predicted by the reservoir model. Additional logs may be obtained during the post-test monitoring period. Data from the well logging events will be obtained electronically in PDF and LAS formats.
- Pressure and temperature (PT) will be measured using a self-contained pressure and temperature logging device lowered into Piacentine 1-27 on a “piano wire” for several days up to one week at a time during injection trials, flow trials and fall off tests. This PT “memory gauge” will be deployed and retrieved by a logging contractor, and the data will be provided after retrieval electronically in ASCII and XLS format.
- The Injection/Withdrawal Well will be fitted with downhole and wellhead PT sensors that will be hard wired to the central data acquisition and control module. The control logic for the wellhead pressure sensor will include an alarm and interlock that closes the automated control

valve and prevents wellhead injection pressure from exceeding the maximum injection pressure allowed under the UIC permit for the well.

- Piacentine 1-27 will be fitted with a wellhead PT sensor. Because this well is less proximal to the central data acquisition module, data will be transmitted to the module wirelessly.
- The Injection/Withdrawal Well and Piacentine 1-27 will be fitted with annular PT sensors. The sensors for the Injection/Withdrawal Well will be hard wired to the central data acquisition and control module, and the sensors for the Piacentine 1-27 well will transmit data wirelessly. Pressure will be maintained in the annulus through the injection or bleeding of pressurized nitrogen from a connected nitrogen tank to address potential pressure changes due to temperature variations in the injection and withdrawal flow (see Attachments H and P). Any adjustments to the annular pressure through nitrogen addition or bleeding will be hand recorded in a separate log.

INJECTION/WITHDRAWAL PIPELINE MANIFOLD INSTRUMENTATION

The following instrumentation will be fitted to the shared injection/withdrawal pipeline manifold near the Injection/Withdrawal Well wellhead:

- Two hydrocarbon sensors will be installed in series as close to the Injection/Withdrawal Well wellhead as practicable. The sensors will operate on two different technologies (infrared [IR] detector and flame ionization detector [FID]) to provide more robust detection capability for varying conditions. Both hydrocarbon sensors will be hard wired to the central data acquisition and control module. Calibration checks will be run daily using an internal instrument gas standard to verify detector accuracy. During test Phases 1-3, an alarm will sound when the concentration of total hydrocarbon vapor as methane in the withdrawn oxygen-depleted air reaches 2% by volume, and an interlock shutting down all flow and shutting in the well (by closing the automated control valve) will trip if concentrations reach 5% by volume. The alarm and interlock settings would be adjusted to 1% and 2%, respectively, if supplemental testing using ambient air is conducted during Phase 5.
- A flame sensor will also be installed as part of the Injection/Withdrawal Well manifold monitoring package and hard wired to the central data acquisition and control system. If the flame sensor is activated, an alarm will sound and the master automated valve will immediately close.

- Redundant oxygen sensors will be installed on the Injection/Withdrawal pipeline between the nitrogen generator and the wellhead to continuously monitor the oxygen content of injected gas. The sensors will be hard wired to the central data acquisition and control module. If oxygen concentrations exceed 5.5%, an alarm will sound, and if concentrations exceed 6%, and interlock shutting down all injection and closing the automated control valve will be triggered.
- A gas sampling port will be located on the injection/withdrawal pipeline near the wellhead and used to collect samples during injection and flow for laboratory analysis to verify the accuracy of the hydrocarbon and oxygen meters. In addition, the sampling port would be used during flow to collect daily grab samples to be field checked with a multi-gas meter for safety confirmation.

INJECTION LEG INSTRUMENTATION

Instrumentation associated with the injection leg of the surface facilities, including the compressor train and nitrogen-generation equipment, would be determined by the contractor providing this equipment, and is expected to include temperature, pressure, and oxygen sensors hard wired to the central data acquisition and control module. In addition, a temperature-compensated plate orifice flow meter (with volume totalizer) will be installed on the injection pipeline to measure gas injection rates. The flow meter will be hard wired to the central data acquisition and control module.

FLOW LEG INSTRUMENTATION

Instrumentation associated with the flow leg of the surface facilities, including the test separator, produced water tank and vent stack, will be determined based on detail design by the equipment contractor. It is specified to include the following:

- Pressure and temperature sensors associated with the test separator that is hard wired to the central data acquisition and control system;
- A temperature-compensated orifice plate flow meter (with volume totalizer) on the outlet of the test separator that would serve as the withdrawal and vent stack flow meter that is hard wired to the central data acquisition and control system for operational and compliance purposes;
- A level sensor in the produced water storage tanks that is hard wired to the central data acquisition and control system;
- A vent stack sampling port used to collect emissions compliance samples for laboratory analysis;
- A produced water sampling port to collect water samples for laboratory analysis for technical data evaluation will be located at the test separator; and
- A second produced water sampling port to collect water samples for laboratory analysis in support of waste characterization will be located at the produced water tank.

CENTRAL DATA ACQUISITION SYSTEM

Except as noted above, all sensors will be hard wired to a central data acquisition and control system with the following characteristics:

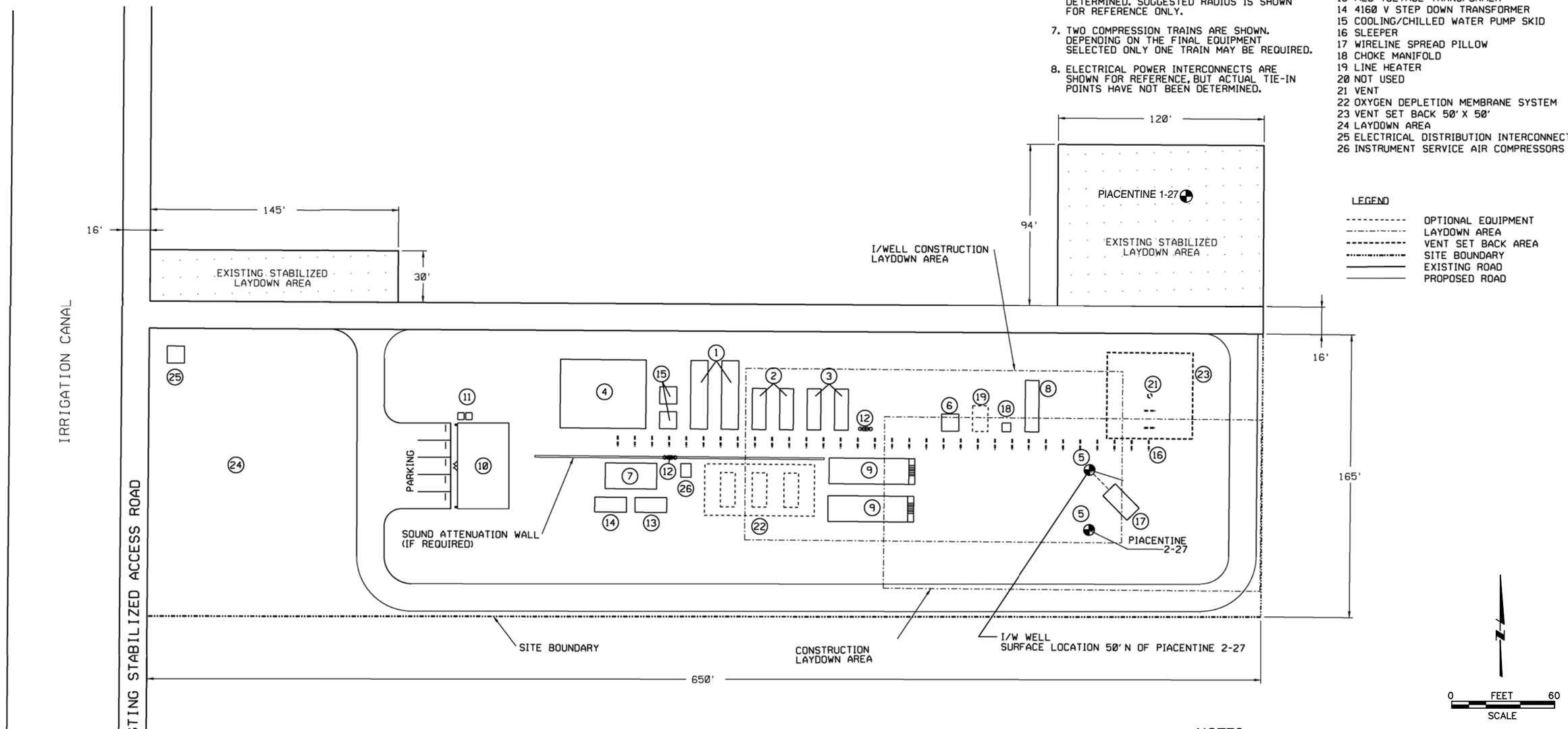
- A hybrid data acquisition, control and safety system will be utilized, including a desktop work station, a hybrid controller, separate input/output (I/O) chassis process sensor I/O and Emergency Shut Down/Fire and Gas System (EGS/FGS) I/O, and Programmable Logic Control (PLC), all connected via non-redundant Ethernet or Modbus links;
- Data polling of sensor output would occur on intervals of a few microseconds (essentially continuously) and provide input for EGS/FGS and PLC functions;
- Data would be permanently recorded on a redundant hard drive data historian in the desktop work station at intervals of 30 seconds;
- Continuous data can be downloaded from the system memory for a period of approximately 24 hours before being over-written;
- Data records will include the sensor channel, time and reading; and
- The system will be provided with an uninterruptable power supply so that critical data acquisition for system operation and compliance can continue in the event of a power failure or outage, and acquired data will not be lost.

NOTES

1. THIS DRAWING IS CONCEPTUAL AND NOT INTENDED FOR DETAILED DESIGN.
2. PERIMETER ACCESS ROAD IS 16' WIDE (TYPICAL).
3. AN EXCLUSION FENCE IS PROPOSED ALONG SITE BOUNDARY LINES.
4. LOCATION OF ALL EXISTING AND PROPOSED EQUIPMENT IS APPROXIMATE.
5. OPERATIONS LAYOUT IS SHOWN. DRILLING AND COMPLETION/CONSTRUCTION LAYOUTS WILL DIFFER.
6. VENT SAFETY ZONE RADIUS HAS NOT BEEN DETERMINED. SUGGESTED RADIUS IS SHOWN FOR REFERENCE ONLY.
7. TWO COMPRESSION TRAINS ARE SHOWN. DEPENDING ON THE FINAL EQUIPMENT SELECTED ONLY ONE TRAIN MAY BE REQUIRED.
8. ELECTRICAL POWER INTERCONNECTS ARE SHOWN FOR REFERENCE, BUT ACTUAL TIE-IN POINTS HAVE NOT BEEN DETERMINED.

PLANT DESCRIPTION

1 LP COMPRESSION SKID
2 BOOSTER COMPRESSION SKID
3 HP COMPRESSION SKID
4 AIR COOLED SYSTEM (CHILLER & HEAT EXCHANGERS)
5 WELLHEAD
6 DATA ACQUISITION SYSTEM
7 POWER DISTRIBUTION CENTER
8 TEST SEPARATOR
9 PORTABLE 21,000 GALLON WATER TANK
10 OFFICE TRAILER
11 SELF-CONTAINED PORTABLE TOILET
12 LIGHT
13 MED VOLTAGE TRANSFORMER
14 4160 V STEP DOWN TRANSFORMER
15 COOLING/CHILLED WATER PUMP SKID
16 SLEEPER
17 WIRELINE SPREAD PILLOW
18 CHOKE MANIFOLD
19 LINE HEATER
20 NOT USED
21 VENT
22 OXYGEN DEPLETION MEMBRANE SYSTEM
23 VENT SET BACK 50' X 50'
24 LAYDOWN AREA
25 ELECTRICAL DISTRIBUTION INTERCONNECT
26 INSTRUMENT SERVICE AIR COMPRESSORS



LEGEND

- OPTIONAL EQUIPMENT
- LAYDOWN AREA
- VENT SET BACK AREA
- SITE BOUNDARY
- EXISTING ROAD
- PROPOSED ROAD

NOTES:

DATA BY WORLEYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON JAMES & ASSOCAITES, INC.

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Prepared for
Pacific Gas and Electric Company

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPROVED BY
03.WP.004	01/02/14	PEM	RF

FIGURE K-1

TEMPORARY SITE FACILITY GENERAL ARRANGEMENT

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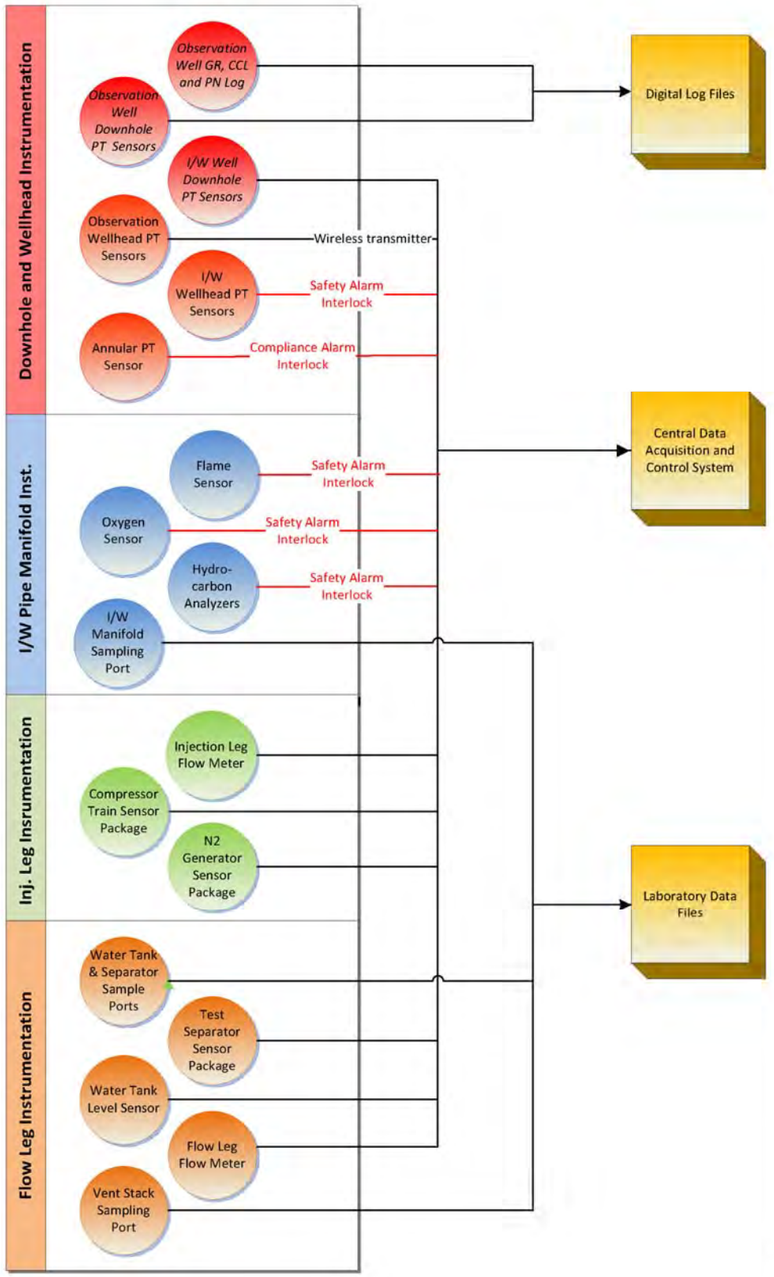

Data Application			Data Collection		
Technical	Compliance	Operations	Data Storage Frequency	Download/ Reporting Frequency	Field Observation/ Verification Frequency
X			NA	ASAP	NA
X			30 sec	Weekly	NA
X			30 sec	Daily	Startup/Test: Real time; Else weekly
X			30 sec	Daily	Startup/Test: Real time; Else weekly
X	X	X	30 sec	Daily	Startup/Test: Real time; Else weekly
	X	X	Hourly	Daily	Weekly
		X	NA	NA	Weekly
X		X	30 sec	Daily	Startup: Real time; Else weekly
X		X	30 sec	Daily	Real time during flow
X			NA	NA	At startup, end of bubble build, start/ end of each test
X	X	X	30 sec	Daily	Startup: Real time; Else weekly
		X	TBD	Daily	Weekly
		X	TBD	Daily	Weekly
X	X		NA	NA	At start and end of flow
		X	TBD	Daily	Weekly
X		X	Hourly	Daily	Weekly
	X		Hourly	Daily	Weekly
	X		NA	NA	At start and end of flow

NOTES:

DATA BY WORLEYPARSONS GROUP

FIGURE PREPARED BY: JACOBSON JAMES & ASSOCAITES, INC.

Prepared for
Pacific Gas and Electric Company

PG&E CAES PROJECT
COMPRESSION TESTING I/W WELL UIC APPLICATION
SAN JOAQUIN COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APPROVED BY
03.WP.004	01/02/14	PEM	RF

FIGURE K-2
COMPRESSION TESTING INSTRUMENTATION STRATEGY MATRIX

J:\GIS\WPPGE_CAES\SectionF\Figure K-02 CompTest Matrix.dwg

NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS SEE DRAWINGS PSGS-1-DW-012-305-002, 003, AND 004.

COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY
PROCESS FLOW DIAGRAMS

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC. ENGINEER	PROJ. ENGR MANAGER	PROJECT MANAGER
A	XX XX 13	ISSUE FOR REVIEW	DM	FS	DM	FS		AZ	BP

PRELIMINARY STATUS — DATE
LDE F. SANCHEZ — 08/26/13
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — DATE
LDE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: D. MRKACEK	
CHECKED BY: F. SANCHEZ	
LEAD DESIGNER: D. MRKACEK	
ENGINEER/TECH SPECIALIST: F. SANCHEZ	
PROJECT ENGINEERING MANAGER: A. ZIMMERMAN	
PROJECT MANAGER: B. PIETRUCHA	

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LIC. NO.: _____ DATE: _____

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resources & energy

CLIENT/PROJECT TITLE
PACIFIC GAS AND ELECTRIC
COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY

PROCESS FLOW DIAGRAM
TITLE PAGE
TEMPORARY SITE FACILITY

SCALE: NONE
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: PGCS-1-DW-012-305-001
REV: B

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$$$$DATE$$$$ $$$$TIME$$$$

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GENERAL INSTRUMENT OR FUNCTION SYMBOLS

- FIELD MOUNTED DISCRETE INSTRUMENTS
- PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR DISCRETE INSTRUMENTS
- AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR DISCRETE INSTRUMENT
- BACK OF LOCAL PANEL
- FIELD MOUNTED SHARED DISP/CONTROL
- PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR SHARED DISP/CONTROL
- AUXILARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR SHARED DISP/CONTROL
- FIELD MOUNTED PLC (SDS)
- PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR PLC (SDS)
- AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR PLC (SDS)
- A DASHED LINE MAY BE USED TO DEPICT INACCESSIBLE DEVICES
- INSTRUMENT SHARING COMMON HOUSING
- PURGE OR FLUSHING DEVICE
- RESET FOR LATCH TYPE ACTUATOR
- UNDEFINED INTERLOCK LOGIC
- DIAPHRAGM SEAL
- PANEL MOUNTED PATCHBOARD POINT 12
- LEVEL GAUGE WITH ILLUMINATOR
- LEVEL GAUGE
- VIBRATION SWITCH
- RESISTANCE (BULB) TEMPERATURE DETECTOR
- PILOT LIGHT
- G-GREEN R-RED O-ORANGE B-BLUE LIGHT - CLEAR EQUIPMENT - G: RUNNING R: OFF O: PERM. RUN VALVE - G: OPEN R: CLOSED B: INHIBIT LOCK
- SELECTOR SWITCH (MULTI CURCUITS)
- SELECTOR SWITCH H: HAND, O: OFF, A: AUTOMATIC
- FLAME DETECTOR
- SPARK IGNITER

- WIRING OR TUBING PROVIDED FOR TREND RECORDER PATCH
- PURGE
- VARIBLE SPEED DRIVE
- START / STOP / AOM — PUMP LOCAL CONTROL STATION (TYPICAL)

FLOW ELEMENT SYMBOLS

- ORIFICE PLATE IN QUICK CHANGE FITTING
- POSITIVE DISPLACEMENT TYPE FLOW TOTALIZING INDICATOR
- TURBINE OR PROPELLER TYPE PRIMARY ELEMENT
- SINGLE PORT PITOT TUBE OR PITOT VENTURI TUBE
- AVERAGING PITOT TUBE
- VENTURI TUBE
- FLOW NOZZLE
- ORIFICE PLATE
- ORIFICE PLATE WITH TAPPED FLANGES
- ORIFICE PLATE WITH VENA CONTRACTA TAPS
- VARIABLE AREA FLOW INDICATOR
- POSITIVE DISPLACEMENT TYPE FLOW TOTALIZER
- FLOW STRAIGHTENING VANE (USE OF TAG NUMBER OPTIONAL)
- VORTEX SENSOR
- ULTRA SONIC FLOW METER
- CORIOLIS FLOW METER
- RESTRICTION ORIFICE

- CALIBRATED LEVEL GAUGE
- MAGNETIC FLOWMETER

TEMPERATURE ELEMENT SYMBOLS

- TEMPERATURE INDICATOR CONNECTION WITH WELL
- SURFACE MOUNTED TEMPERATURE SENSOR
- THERMOCOUPLE RESISTANCE BULB (RTD) OR THERMISTOR (TH) CONNECTED TO TEMPERATURE INDICATOR

SELF ACTUATED DEVICES PRESSURE

- PILOT OPERATED PRESSURE SAFETY VALVE
- PRESSURE RELIEF OR SAFETY VALVE GENERAL SYMBOL
- PRESSURE VACUUM RELIEF OR SAFETY VALVE DUAL INSTALLATION
- VACUUM RELIEF VALVE GENERAL SYMBOL
- THERMAL SAFETY VALVE
- RUPTURE DISK OR SAFETY HEAD FOR VACUUM RELIEF
- RUPTURE DISK OR SAFETY HEAD FOR PRESSURE RELIEF

FUNCTION DESIGNATIONS

A/D	ANALOG/DIGITAL	1:1	BOOST
I/D	INVERSE DERIVATIVE	I-O	ON-OFF
D	DERIVATIVE OR RATE	S	SOLENOID
>	HIGH-SELECTOR	△	DIFFERANCE
<	LOW-SELECTOR	1:3	GAIN
Σ	ADD	REV	REVERSE
⁚	BIAS	X	MULTIPLY
÷	DIVIDE	I	INTEGRATE
AVG	AVERAGE	X^a	RAISE TO POWER
F(X)	CHARACTERIZE	√	EXTRACT SQUARE ROOT
⁰/₀	(FOR INPUT OUTPUT OF THE FOLLOWING)	⊗	DIFFERENCE

HEAT TRACING IDENTIFICATION (CONT)

- HEAT INSTRUMENT HOUSE
- UNHEATED INSTRUMENT HOUSE
- HEAT TRACED INSTRUMENT

SIGNAL CONVERSION

DESIGNATION	SIGNAL
E	VOLTAGE
I	CURRENT
H	HYDRAULIC
O	ELECTROMAGNETIC SONIC SIGNAL OR LIGHT BEAM
P	PNEUMATIC
R	RESISTANCE

LOGIC SYMBOLS

- OR — OR - OUTPUT EXISTS IF ONE OR MORE OF THE INPUTS EXISTS
- AND — AND - OUTPUT IF AND ONLY IF ALL THE INPUTS EXIST
- SDS — SHUTDOWN SYSTEM
- .. — LOGIC DIAGRAM REFERENCE
- CC — COMPRESSOR CONTROLS
- HCP — HEATER CONTROL PANEL
- HC — HOT OIL CONTROLS

NOT FOR CONSTRUCTION
FOR BIDDING REFERENCE ONLY

IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIBLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION				
C	CONDUCTIVITY			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	GAUGING (DIMENSIONAL)		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME	RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	(UNCLASSIFIED)				
O	(UNCLASSIFIED)		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONN.		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH, SELECTOR	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VISCOSITY			VALVE, DAMPER LOUVER	
W	WEIGHT, FORCE		WELL		
X	(UNCLASSIFIED)	X AXIS	(UNCLASSIFIED)	(UNCLASSIFIED)	(UNCLASSIFIED)
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY COMPUTE CONVERT	
Z	POSITION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFED FINAL CONTROL ELEMENT	

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	TECH SPEC	LEAD DISC ENG/SPEC	PROJ ENGR MGR	PROJECT MANAGER
A	XX XX 13	ISSUE FOR REVIEW	DM	FS	DM	FS		AZ	BP

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE F. SANCHEZ 08/26/13

APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: D. MRKACEK	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: STATE: LIC. NO.: DATE:
CHECKED BY: F. SANCHEZ	
LEAD DESIGNER: D. MRKACEK	
ENGINEER/TECH SPECIALIST: F. SANCHEZ	
PROJECT ENGINEERING MANAGER: A. ZIMMERMAN	
PROJECT MANAGER: B. PIETRUCHA	

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WorleyParsons resources & energy

CLIENT/PROJECT TITLE
PACIFIC GAS AND ELECTRIC
COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY

PROCESS FLOW DIAGRAM
LEGEND SHEET 1

SCALE: NONE — DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: PGCS-1-DW-012-305-002 — REV: B

$$DESIGN-FILE-NAME$$
$$$$DATE$$$ $$$$TIME$$$$

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ACTUATOR SYMBOLS/CONTROL VALVES

- DIAPHRAGM SPRING OPPOSED OR UNSPECIFIED ACTUATOR
- DIAPHRAGM PRESSURE BALANCED
- CYLINDER WITHOUT POSITIONER OR OTHER PILOT DOUBLE ACTING
- ROTARY MOTOR (WITH ELECTRICAL SIGNAL) — M
- SOLENOID — S
- HAND ACTUATOR OR HANDWHEEL
- PRESSURE REDUCING REGULATOR SELF CONTAINED
- PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TRAP
- TWO WAY VALVE FAIL OPEN — FO
- TWO WAY VALVE FAIL CLOSED — FC
- THREE WAY SOLENOID VALVE FAIL OPEN PATH SHOWN UNSHADED — S
- DIAPHRAGM ACTUATED WITH I/P POSITIONER
- DOUBLE ACTING ACTUATOR — S, S
- 5/2 SOLENIOD VALVE

CONTROL VALVES

- FLOW REGULATOR SELF CONTAINED
- EXCESS FLOW VALVE
- VALVE ACTION (SEE ABBREVIATIONS) — FO
- SOLENOID VALVE WITH RESET FAIL OPEN PATH SHOWN UNSHADED — S, R
- UNCLASSIFIED CONTROL VALVE

MANUALLY OPERATED VALVES

- GATE
- GLOBE
- CHECK
- PLUG
- HAND CONTROL
- BALL
- BUTTERFLY OR DAMPER
- STOP CHECK
- BLOWDOWN
- VALVE WITH BLEED OR PURGE CONN. UNDER DISC
- DIAPHRAGM
- ANGLE
- THREE WAY
- FOUR WAY
- ROTARY VALVE
- NEEDLE VALVE
- FOR OTHER VALVES INDICATE PROPER ABBREVIATIONS UNDER VALVE (SEE ABBRV. BELOW) — TS

MECHANICAL CONNECTING DEVICES

- PIPING SPECIFICATION CHANGE X-TYPE — X, X
- FLEXIBLE HOSE
- FLEXIBLE JOINT
- EXPANSION JOINT
- KAMLOCK CONNECTION
- SNAPLOCK CONNECTION
- HOSE CONNECTION

FIRE AND SAFETY

- SAFETY SHOWER
- EYE WASH
- COMBINED SAFETY SHOWER AND EYE WASH
- STANDARD DOUBLE HYDRANT ASSEMBLY
- STANDARD FOAM MONITOR ASSEMBLY

PRESSURE VESSELS

- VERTICAL PRESSURE VESSEL
- HORIZONTAL PRESSURE VESSEL
- VERTICAL PRESSURE VESSEL W,X,Y,Z-TRAY NO. AND IDENTIFICATION — W, X, Y, Z
- VERTICAL-PACKED
- HORIZONTAL WITH BOOT
- 'PORTATEST' SCRUBBER
- VORTEX BREAKER (FLUSH MOUNTED)
- VORTEX BREAKER (ELEVATED)
- MANWAY
- MIST MAT
- VANE PACK
- VANE TYPE INLET DEVICE

PUMPS

- DIAPHRAGM PUMP
- POSITIVE DISPLACEMENT PUMP
- PISTON PUMP (RECIPROCATING)
- BOOSTER CENTRIFUGAL-MULTISTAGE
- EXTENDED SHAFT ELECTRIC SUMP PUMP — M
- PNEUMATICALLY DRIVEN PUMP
- CENTRIFUGAL PUMP

HEATING/COOLING DEVICES

- AIR COOLED — M
- WATER BATH HEATER-ELECTRIC
- SHELL AND TUBE EXCHANGER
- GAS FIRED BATH HEATER

COMPRESSORS

- CENTRIFUGAL MOTOR DRIVEN — M
- CENTRIFUGAL TURBINE DRIVEN — T
- SCREW COMPRESSOR VARIABLE SPEED MOTOR DRIVEN — VS
- RECIPROCATING COMPRESSOR ENGINE DRIVER — E

TANKS

- FIXED ROOF TANK
- ROAD TANKER
- TRAILER MOUNTED TANK

MISCELLANEOUS

- CONE STRAINER
- BASKET STRAINER
- TEE STRAINER
- STATIC MIXER — MX
- CONICAL FILTER
- BARRED TEE
- PULSATION DAMPENER
- SPECTACLE BLIND INSTALL DONUT IN LINE
- SPECTACLE BLIND INSTALL DISK IN LINE
- DRAIN FUNNEL SEE ABBREVIATIONS — D
- EXPANSION JOINT
- INSULATION JOINT
- LUBRICATOR
- INSERT
- FILTER — F
- Y STRAINER
- CONDENSATE TRAP OR LIQUID AUTO DRAIN — T
- TIE-IN POINT — TP
- SPECIALTY ITEM — SP
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	TECH. SPEC.	LEAD ENGR.	PROJ. ENGR.	PROJECT MANAGER
A	XX XX 13	ISSUE FOR REVIEW	DM	FS	DM	FS		AZ	BP

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE F. SANCHEZ 08/26/13

APPROVED STATUS — DATE — REPRESENTS REVIEWED AND APPROVED DESIGN, ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE

ORIGINATING PERSONNEL

DRAWN BY: D. MRKACEK
CHECKED BY: F. SANCHEZ
LEAD DESIGNER: D. MRKACEK
ENGINEER/TECH SPECIALIST: F. SANCHEZ
PROJECT ENGINEERING MANAGER: A. ZIMMERMAN
PROJECT MANAGER: B. PIETRUCHA

PROFESSIONAL ENGINEER'S SEAL

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
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resources & energy

CLIENT/PROJECT TITLE
PACIFIC GAS AND ELECTRIC
COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY

PROCESS FLOW DIAGRAM
LEGEND SHEET 2

SCALE: NONE
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: PGCS-1-DW-012-305-003
REV: B

$$DESIGN-FILE-NAME$$
$$$$DATE$$ $$$$TIME$$$$

EQUIPMENT NUMBERS

X - XXX

- EQUIPMENT TYPE
  - C COMPRESSOR
  - E EXCHANGER
  - F FILTER
  - G GENERATOR
  - H FIRED HEATER
  - P PUMP
  - T TANK
  - U UNCLASSIFIED
  - V PRESSURE VESSEL
  - X PACKAGE EQUIPMENT
- SEQUENTIAL NUMBER

SYSTEM DESIGNATORS PBS DESCRIPTION

Ø12	GENERAL - NO SYSTEM
519	WATER/GAS - SAMPLING
521	PLANT EQUIPMENT DRAINS
526	WASTE WATER TREATMENT
543	COMPRESSED AIR
544	INSTRUMENT AIR
548	NITROGEN SYSTEM
527	PLANT FIRE PROTECTION

TANKS

TANK BREATHER

TANK VENT WITH BIRD SCREEN

TANK VENT

CONTINUATIONS

DRG. NO. — CONTINUATION TO DRG. NO. SHOWN

DRG. NO. — CONTINUATION FROM DRG. NO. SHOWN

DRG. NO. — CONTINUATION TO/FROM DRG. NO. SHOWN

TO UTILITY DRG. NO.

UTILITY CONNECTION TO DRG. NO. SHOWN INCLUDING :

F : HIGH PRESSURE VENT

C : CLOSED DRAIN (HAZARDOUS)

D : OPEN DRAIN

ABBREVIATIONS

AG	ABOVE GROUND
AOM	AUTOMATIC/OFF/MANUAL
AUTO	AUTOMATIC
BG	BELOW GROUND
BD	BLOWDOWN
BW	BUTT WELD
CD	CHEMICAL DRAIN
CO	CHAIN OPERATED
CSC	CAR SEAL CLOSE
CSO	CAR SEAL OPEN
CSS	COMPRESSOR SHUTDOWN SYSTEM
CW	COOLING WATER
DCS	DISTRIBUTED CONTROL SYSTEM
(F)	FURNISHED
FB	FULL BORE
(F&P)	FURNISHED AND PIPED
FC	FAIL CLOSE
FD	FLEX DISC VALVE
FI	FAIL INDETERMINATE
FL	FAIL LAST
FO	FAIL OPEN
GO	GEAR OPERATOR
HH	HANDHOLE
HLL	HIGH LIQUID LEVEL
HP	HORSE POWER-HIGH PRESS.
H.PT	HIGH POINT
IAS	INSTRUMENT AIR SUPPLY
LC	LOCK CLOSE
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
LLL	LOW LIQUID LEVEL
LO	LOCK OPEN
LP	LOW PRESSURE
L.PT	LOW POINT
LSSH	LEVEL SWITCH SHUT-OFF
MAN	MANUAL
MBB	MAKE BEFORE BREAK
MEG	MONO ETHYLENE GLYCOL
MH	MANHOLE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NIL	NORMAL INTERFACE LEVEL
NLL	NORMAL LIQUID LEVEL
OD	OILY WATER DRAIN
O.RB	ORBIT VALVE
OV	OPERATING VALVE
PG	POWER GAS
PO	PUMP OUT
RTU	REMOTE TELEMETRY UNIT
SC	SAMPLE CONNECTION
SD	STORM AND CLEAN WATER DRAIN
SDS	SHUTDOWN SYSTEM
SCP	STATION CONTROL PANEL
SO	STEAM OUT
SP	SET POINT
SP.GR.	SPECIFIC GRAVITY
SS	SOFT SEAT VALVE
SST	STAINLESS STEEL TRIM
TEG	TRI ETHYLENE GLYCOL
TS	GENERAL TWIN SEAL
TSO	TIGHT SHUT OFF
T/T	TANGENT TO TANGENT
UCP	UNIT CONTROL PANEL
VSD	VARIABLE SPEED DRIVE

INSTRUMENT TAG NUMBERS

XXXX

- INSTRUMENT TYPE

E.G.. PT. LSH. TSLL

LINE AND PIPING SYMBOLS

- PROCESS INSTRUMENT LINE
- UNDEFINED SIGNAL
- PNEUMATIC SIGNAL
- OR — ELECTRICAL SIGNAL
- INSTRUMENT CAPILLARY TUBING
- HYDRAULIC SIGNAL
- ELECTROMAGNETIC SONIC SIGNAL OR LIGHT BEAM
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- MECHANICAL LINK
- HEAT TRACED LINE
- LINE PIPE INSULATION
- VESSEL INSULATION
- VENDOR SCOPE OF SUPPLY
- GRADE OR GROUND SURFACE

NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS SEE DRAWINGS PSGS-1-DW-012-305-002, 003, AND 004.
2. EXCEPT AS NOTED, ALL EQUIPMENT, PIPING, VALVES AND INSTRUMENTS SHOWN ON THIS DRAWING ARE BY THE TSF CONTRACTOR.
3. DIVISION OF RESPONSIBILITY IS BY MATERIAL ONLY; DESIGN BY THE TSF CONTRACTOR.
4. INSTRUMENTS AND VALVES SHOWN ON THIS DRAWING ARE CONCEPTUAL ONLY; THE TSF CONTRACTOR NEEDS TO ENGINEER THE SYSTEM TO ARRIVE AT THE REQUIRED INSTRUMENTS AND VALVES.
5. TIE-INS TO AIR AND NITROGEN INJECTION PACKAGE ARE PRELIMINARY, AND WILL BE DETERMINED DURING DETAILED DESIGN BASED ON INFORMATION FROM THE AIR AND NITROGEN PACKAGE VENDOR.

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/TECH SPEC	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
A	xx xx 13	ISSUE FOR REVIEW	DM	FS	DM	FS		AZ	BP

PRELIMINARY STATUS — DATE
LDE F. SANCHEZ 08/26/13
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — DATE
LDE
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: D. MRKACEK	
CHECKED BY: F. SANCHEZ	
LEAD DESIGNER: D. MRKACEK	
ENGINEER/TECH SPECIALIST: F. SANCHEZ	
PROJECT ENGINEERING MANAGER: A. ZIMMERMAN	
PROJECT MANAGER: B. PIETRUCHA	

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CLIENT/PROJECT TITLE
PACIFIC GAS AND ELECTRIC
COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY

PROCESS FLOW DIAGRAM LEGEND SHEET 3

SCALE: NONE
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: PGCS-1-DW-012-305-004
REV: B

$$DESIGN-FILE-NAME$$
$$DATE$$ $$TIME$$

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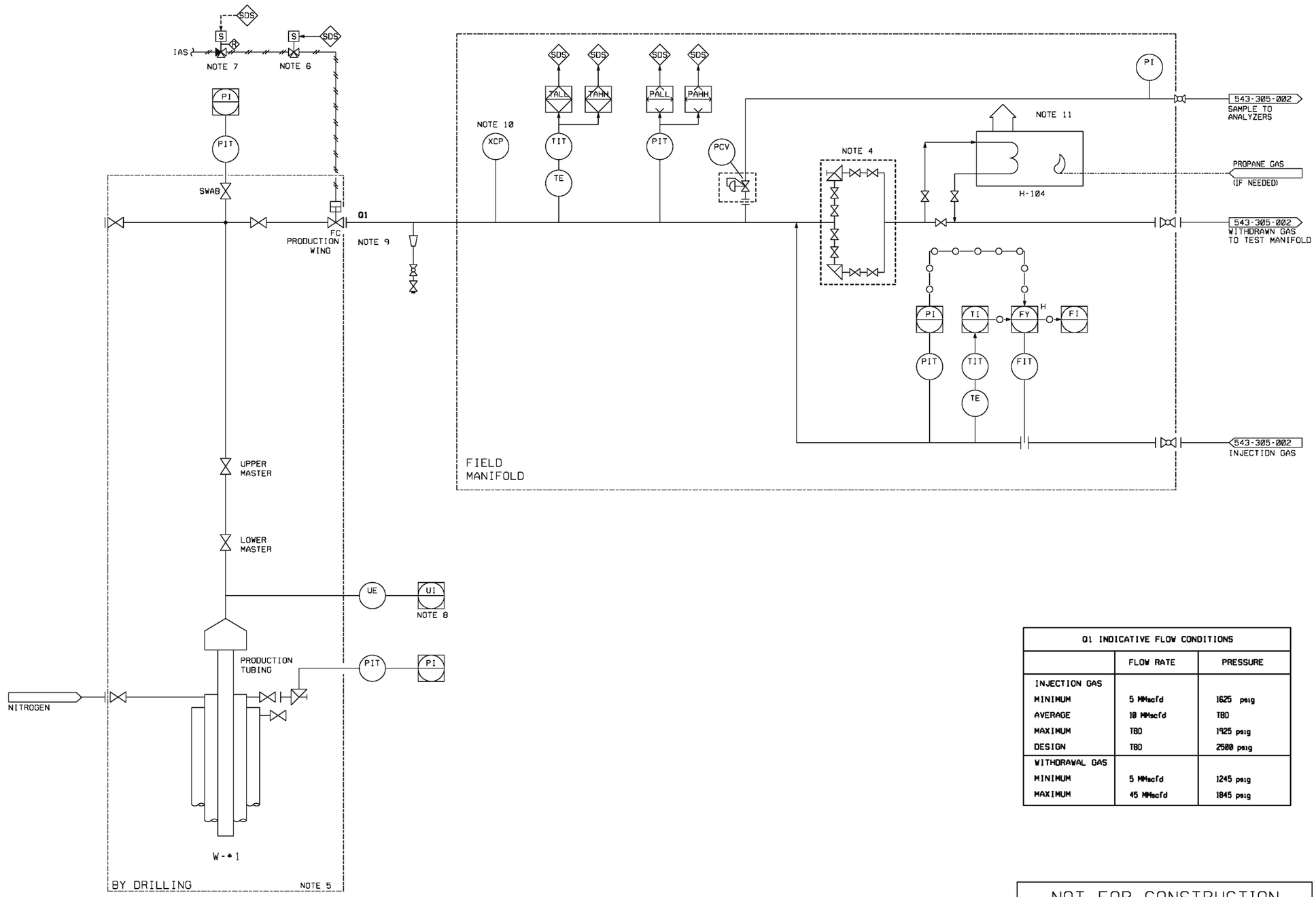

LEGEND:

PROPANE

AIR/NITROGEN

NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS SEE DRAWINGS PSGS-1-DW-012-305-002, 003, AND 004.
2. EXCEPT AS NOTED, ALL EQUIPMENT, PIPING, VALVES AND INSTRUMENTS SHOWN ON THIS DRAWING ARE BY THE BOP CONTRACTOR.
3. THIS DRAWING IS REPRESENTATIVE OF THE PROCESS FLOW DESIGN EXPECTED AND IS BASED ON CONCEPTUAL ENGINEERING. ALL INFORMATION IS SUBJECT TO CHANGE DURING FINAL DESIGN.
4. CHOKE MANIFOLD.
5. DETAILS TO BE CONFIRMED BY DRILLING CONTRACTOR.
6. CLOSE ON PLANT ESD.
7. CLOSE ON WELLHEAD AREA ESD.
8. PERMANENT DOWNHOLE PRESSURE AND TEMPERATURE INSTRUMENTATION TO BE SUPPLIED BY TBD.
9. API 6A TYPE TBD FLANGE.
10. GAS SAMPLE PORT.
11. AN INLINE WATER BATH HEATER SHALL BE PROVIDED IF REQUIRED TO PREVENT FREEZING DOWN STREAM OF THE CHOKE MANIFOLD. IT IS PREFERRED THAT THE INLINE WATER BATH HEATER BE ELECTRIC, BUT IF STANDARD GAS FIRED EQUIPMENT IS AVAILABLE FOR RENT IT WILL BE CONSIDERED IF IT REQUIRES LESS THAN 2 MMBTU/HR.
12. FINAL DESIGN WILL REQUIRE ADDITIONAL ISOLATION VALVING (NOT SHOWN) FOR MAINTENANCE DURING OPERATIONS.
13. WITHDRAWAL PROCESS SHOWN. VALVE POSITIONS WILL DIFFER FOR INJECTION PROCESS.

Q1 INDICATIVE FLOW CONDITIONS

	FLOW RATE	PRESSURE
INJECTION GAS		
MINIMUM	5 MMscfd	1625 psig
AVERAGE	10 MMscfd	TBD
MAXIMUM	TBD	1925 psig
DESIGN	TBD	2500 psig
WITHDRAWAL GAS		
MINIMUM	5 MMscfd	1245 psig
MAXIMUM	45 MMscfd	1845 psig

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH. SPEC.	LEAD DISC ENGINEER	PROJ ENGR MANAGER	PROJECT MANAGER
B	10 17 13	INCLUDED CLIENT COMMENTS	AP	FS	DM	FS		AZ	BP
A	09 13 13	ISSUED FOR INFORMATION	DM	FS	DM	FS		AZ	BP

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LDE F. SANCHEZ 08/26/13

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ORIGINATING PERSONNEL

DRAWN BY: D. MRKACEK
CHECKED BY: F. SANCHEZ
LEAD DESIGNER: D. MRKACEK
ENGINEER/TECH SPECIALIST: F. SANCHEZ
PROJECT ENGINEERING MANAGER: A. ZIMMERMAN
PROJECT MANAGER: B. PIETRUCHA

PROFESSIONAL ENGINEER'S SEAL

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WorleyParsons resources & energy

CLIENT/PROJECT TITLE
PACIFIC GAS AND ELECTRIC
COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY

PROCESS FLOW DIAGRAM
KING ISLAND
TEST WELL #1 AND TEST WELL FIELD MANIFOLD

SCALE: NONE
DRAWING SIZE: ARCH D (36" x 24")
WORLEYPARSONS DWG. NO.: PGCS-1-DW-543-305-001
REV: B

##DESIGN-FILE-NAME## ###DATE### ####TIME####

LEGEND:

AIR/NITROGEN _____

WATER .....

Q1 INDICATIVE FLOW CONDITIONS		
	FLOW RATE	PRESSURE
INJECTION GAS		
MINIMUM	5 MMscfd	1625 psig
AVERAGE	10 MMscfd	TBD
MAXIMUM	TBD	1925 psig
DESIGN	TBD	2500 psig
WITHDRAWAL GAS		
MINIMUM	5 MMscfd	1245 psig
MAXIMUM	45 MMscfd	1845 psig

NOTES:

1. FOR GENERAL NOTES, ABBREVIATIONS AND SYMBOLS SEE DRAWINGS PSGS-1-DW-012-305-002, 003, AND 004.
2. EXCEPT AS NOTED, ALL EQUIPMENT, PIPING, VALVES AND INSTRUMENTS SHOWN ON THIS DRAWING ARE BY THE BOP CONTRACTOR.
3. DIVISION OF RESPONSIBILITY IS BY MATERIAL ONLY; DESIGN BY THE BOP CONTRACTOR.
4. THIS DRAWING IS REPRESENTATIVE OF THE PROCESS FLOW DESIGN EXPECTED AND IS BASED ON CONCEPTUAL ENGINEERING. ALL INFORMATION IS SUBJECT TO CHANGE DURING FINAL DESIGN.
5. TIE-INS TO AIR AND NITROGEN INJECTION PACKAGE ARE PRELIMINARY, AND WILL BE DETERMINED DURING DETAILED DESIGN BASED ON INFORMATION FROM THE AIR AND NITROGEN PACKAGE VENDOR.
6. VENT TO ATMOSPHERE AT SAFE LOCATION.
7. VENT STACK TO DRAIN TO WASTE WATER STORAGE TANKS.
8. GAS SAMPLE PORT.
9. GAS DETECTION REQUIRED AROUND SEPARATOR.
10. FINAL DESIGN WILL REQUIRE ADDITIONAL ISOLATION VALVING (NOT SHOWN) FOR MAINTENANCE DURING OPERATIONS.
11. WITHDRAWAL PROCESS SHOWN. VALVE POSITIONS WILL DIFFER FOR INJECTION PROCESS.

NOT FOR CONSTRUCTION
FOR BIDDING REFERENCE ONLY

NOTE 6
TO ATMOS

X-102
GAS ANALYZERS

METHANE AIT — AI — AIR METHANE

AAHH — SDS

543-305-001
TEST WELL #1
SAMPLE

METHANE AIT — AI — AIR METHANE

AAHH — SDS

O2 AIT — AI — AIR O2

AAHH — SDS

XA

O2 AIT — AI — AIR O2

TP 1
ANIP DWG TBD
INJECTION GAS
INJECTION MANIFOLD

FIELD MANIFOLD

543-305-001
GAS TO
WELL W-#1

543-305-001
GAS FROM
WELL W-#1

Q1

TO ATMOS

PALL — SDS

PIC

PIT PIT

S — SDS
FO — IAS

FO

PV

TEST SEPARATOR
V-101
SIZE: TBD
DESIGN: TBD
VESSEL TRIM: TBD

MW

LIT

LIC H L

FQI

FIT

NOTE 9

FC

LV

FI FY H TI PI

FIT TIT PIT

TE

NOTE 8
XCP

NOTE 6
COLD VENT
TO ATMOS.

X-103
NOTE 7

GAS DETECTION TO BE INCLUDED TO TEST SEPARATOR. SDS LOGIC ASSOCIATED TO ESDI IN EVENT OF GAS LEAK WHERE BOTH DETECTORS SEE 40% LEL

DRAIN TO WATER
STORAGE TANKS

526-305-001
PRODUCED WATER
TO STORAGE TANKS

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	TECH. SPEC.	LEAD ENG. MANAGER	PROJ. ENG. MANAGER	PROJECT MANAGER
B	08/17/13	INCLUDED CLIENT COMMENTS	AP	FS	DM	FS		AZ	BP
A	08/05/13	ISSUED FOR INFORMATION	DM	FS	DM	FS		AZ	BP

PRELIMINARY STATUS — DATE — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE F. SANCHEZ 08/26/13

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resources & energy

CLIENT/PROJECT TITLE
PACIFIC GAS AND ELECTRIC
COMPRESSED AIR ENERGY STORAGE PROJECT
TEMPORARY TEST FACILITY

PROCESS FLOW DIAGRAM TEST WELL MANIFOLDS AND TEST SEPARATOR

SCALE NONE
DRAWING SIZE ARCH D (36" x 24")
WORLEYPARSONS DWG. NO. PGCS-1-DW-543-305-002
REV B

##DESIGN-FILE-NAME##
##DATE##
##TIME##

ATTACHMENT L

Construction Procedures

CONTENTS

Section L-1 Requirements

Section L-2 Approach and Rationale

Section L-3 I/W Well Installation Program

Section L-4 Piacentine 1-27 Conversion Program

Attachment L-1 Injection/Withdrawal Test Well Drilling, Completion, and Directional Programs

Attachment L-2 Piacentine 1-27 Conversion Program

L.1 REQUIREMENTS

Discuss the construction procedures to be utilized. This should include details of the casing and cementing program, logging procedures, deviation checks, and the drilling, testing and coring program, and proposed annulus fluid.

L.2 APPROACH AND RATIONALE

The proposed Injection/Withdrawal Well will be installed as a deviated well from the existing well pad used for construction of the Piacentine 2-17 core well. The bottomhole location (used as the well location in this application) will be located approximately 180 feet northeast of the existing Piacentine 1-27 well in order to inject the air at a favorable location in the reservoir structure, and to facilitate use of Piacentine 1-27 and 2-27 as monitoring wells. The well will be drilled using conventional gas well drilling equipment, and will be completed in the top of the reservoir by under-reaming and installing a screen and gravel pack to promote good communication with the reservoir sands. Air will be injected and withdrawn through 5 ½-inch tubing secured in the casing with a packer system and a pressurized annulus. The well will be completed using 600 feet of 14 ¾-inch surface casing and 4,730 feet of 9 5/8-inch long string casing cemented to the surface.

The proposed surface casing (600 feet) will extend below the anticipated Base of Fresh Water as defined by the State of California rather than to the base of Underground Sources of Drinking Water (USDW) as defined by EPA. The proposed Injection/Withdrawal Well is a Class V Experimental Injection Well that will be used for a short-term air injection pilot test. This use is fundamentally different from a commercial wastewater injection well and entails a much lower risk to USDW. We believe the proposed approach is appropriate and fully protective of USDW for the following reasons:

- The proposed 4,730 feet of 9-5/8-inch long string casing will be cemented to surface and will isolate and protect USDW throughout its full vertical extent (approximately 3000 feet). A radial cement bond log will be run after completion of the cementing operation (Attachment P).
- After the well completion, Mechanical Integrity Tests will be performed to insure the integrity of 9-5/8" casing (Attachment P).
- All the air injection and production will be performed through a string of tubing which will be isolated from the 9-5/8-inch casing by a packer (Attachment M). The annulus between tubing and 9-5/8-inch casing will be pressurized and will be monitored on a continuous basis for leaks (Attachment P), providing a second verified layer of protection.
- This well is proposed to be used for a short-term pilot test for no more than approximately 90 days. The chance of well failure during this period is extremely small.

- The pilot testing program has been amended to significantly decrease both the injection rate and final volume, resulting in a considerable reduction in the anticipated pressure buildup.
- Pressures induced in the reservoir during the proposed compression pilot test will dissipate over time, eliminating the risk of fluid migration. The current reduced pressure state of the depleted gas reservoir will speed the time period over which this occurs.
- The injection gas for this well is air or oxygen-depleted air or ambient air, which are non-hazardous, compressible, and entail a lower risk of USDW contamination than commercial use to inject wastewater.

L.3 INJECTION/WITHDRAWAL WELL INSTALLATION PROGRAM

Detailed drilling, completion, and directional programs for the Injection/Withdrawal Well are included in Attachment L-1. A completion detail schematic of the Injection/Withdrawal Well is included in Attachment M.

Deviation checks will be performed at approximately every 500 vertical feet from 700 feet to 3,465 feet by utilizing the measured while drilling (MWD) method. This will ensure the drill hole does not deviate from the plan beyond acceptable limits.

The wellhead will be equipped with 3,000 psi double master 5-1/8" valves, a 5-1/8" wing valve, and a 2-1/16" 3,000 psi casing valve. The tubing hanger and top flange over the tubing head will be modified so that a ¼" cable can be run through the 5-1/2" tubing hanger and through the top flange of the tubing head. A detailed schematic of the surface completion for the Injection/Withdrawal Well is included in Attachment M-2.

Within 30 days following the installation of the Injection/Withdrawal Well, a well completion report will be provided to the EPA. The report will summarize the drilling, casing and cementing operations. The report will include a detailed driller's report documenting all rig activities will be provided, signed by the Engineer in Charge and the Operator. Complete logs will be appended to the report.

L.4 PIACENTINE 1-27 CONVERSION PROGRAM

Piacentine 1-27 will be converted to a monitoring well prior to formation testing. Conversion will include cleaning out the well and installing a tubing and packer system with a pressurized annulus. A detailed conversion program for Piacentine 1-27 is included in Attachment L-2. A well completion detail for the conversion is included as Attachment M-3. A report documenting these activities, similar to that described for the Injection/Withdrawal Well, will be provided to EPA within 30 days after completion of the work.

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King Island Injection/withdrawal Test Well No. 1

Location: Section 27, T 3N, R 5E, MDB&M San Joaquin County, California.
X=1734880.641 Y= 577346.753 (NAD 27, Zone III)
Elevation: -3.75′ ground. +8.25' KB (NGVD 29)

Take all measurements from KB which is 12' above ground.
Keep hole full at all times.
Comply with Standing Orders attached.

Drilling and Completion Program (Drill Pipe: 4-1/2″, 16.6#, XH)
Building Location, Set Conductor, Rat Hole, Mouse Hole

1. **8' X 8′ cellar will be constructed. Rat hole and mouse hole for the rig will be dug by a water well driller.**

2. **20", 53#, 0.25″ wall thickness, ERW conductor pipe be cemented at 60' using a water well driller.**

Rig Move, Drill 17-1/2″ hole to ~600′+, Cement 13-3/8″ surface casing, Install BOE.

1. **Move in drilling rig. Rig up. Install riser and flow line on 20" conductor. Install mud cleaners and centrifuge. Have a full water tank before spud. In addition have a 500 bbl water tank on location and fill it with water.**

2. **Run 17-1/2″ rental bit, 4-16/32" jets, 2 DC, 17-1/2″ Stab, and HW's and drill to 600′+. Use both pumps with 6" liners.**

3. **Run DIL/SP/GR/Caliper logs**

4. **Install mud loggers at shoe of conductor around 60′.**

Cementing program for 13-3/8″ surface casing.

1. **Give cementers 24 hour notice. Cement 13-3/8″, 54.5#, J-55, New casing at ~600′ with 290 sacks Woodland Light cement (Class G, 13.1#, 1.716 cf/sk)followed with 150 sacks Woodland tail cement (Class G, 14.5#, 1.423 cf/sk). Tack weld and Bakerlok bottom 4 collars, weld shoe solid. Run float shoe and insert 40' above shoe. Run centralizer 15', 40′ and 80′ above shoe. Use top rubber plug only and plug holding head. Bump plug on insert with water. Pressure test to 500 psig. If necessary perform 80 sacks top job cement with 3% CaCl2 (top job will be performed if cement level drops in the annulus)**
   Note: The cement volume is calculated at 70% excess.

2. **After 4 hours WOC, land 13-3/8″ casing head (have welders on the hook). Test weld to 500 psig. Install Series 900 (3000#) dual hydraulic control gate and Hydril GK. Test according to Standing Orders. Notify EPA and, if EPA requires, Notify DOGGR to witness. Pressure test casing to 1000 psig. Use Recorded chart for BOE and casing test.**

December 30, 2013

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Drill out 13-3/8″ casing shoe, drill 12-1/4″ hole to 30' above Mokelumne River Formation Sand (Top of sand is estimated to be at 4681' VD)

1. **Drill out the shoe of 13-3/8″ casing with the following BHA: 12-1/4″ long tooth bit with 4-16/32″ for jets (a very good used or retip bit), 2 DC's, 12-1/4″ stab, 3 HW's, jars, 27 HW's. Use both pumps with 6″ liners. Drill to 3465' (~KOP).**

2. **Run MM, MWD and the following directional BHA: 12-1/4″ new long tooth bit with 4-14/32" for jets, 8" MM, 12" stab, float sub, 6-3/4" mule shoe sub (MWD), 6-3/4" monel, 12" stab, 6-3/4", X-over, 3 HW's, jars, 27 Hw's, 4-1/2" DP. Use both pumps with 6″ liners.**

3. **Determine deviation of the wellbore from surface to 3465′ by using MWD to take surveys every 500′ from 700′ to 3465'. Prepare a deviation survey and modify the directional program accordingly. Directionally drill 12-1/4″ hole to around 4700′ MD (4653' VD) or ~28′ above Mokelumne River Formation Sand based on the field geologist. Prepare deviation survey for the entire wellbore. POH. Lay down directional tools.**

3. **Wipe hole every 6 to 8 hours.**

4. **Mud sweep should be used to clean hole before pulling out of hole.**

5. **Have additional 12-1/4″ mill tooth bit on location.**

Reduce hole size to 8-3/4" and drill to TD at 4963' MD = 4900' VD.

1. **Pick up the following BHA. 8-3/4" RT mill tooth bit with 4-14's, bit sub, 2DC's, 3 Hw's, Jars, 27 Hw's. Drill 8-3/4" to TD at 4963' MD = 4900' TVD. Use both pumps.**

2. **Mud weight should be 10 ppg at 4750'.**

3. **Wipe hole every 6 to 8 hours.**

4. **Mud sweep should be used to clean hole before pulling out of hole.**

Conditioning hole before logging.

1. **Wipe 8-3/4" hole from 4963′ to 4600' twice.**

2. **Circulate well at high rate with both pumps for 1+ hours before pulling out to run logs.**

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Logging program for 8-3/4″ hole, 12-1/4″ hole and 13-3/8″ casing.

1. **Run DIL/Neutron/Density/Micro-Resistivity/SP/GR/Dipole Sonic/RFT/6 arm Caliper. (Dipole sonic will provide both shear and compressional) from 600′ to 4963′.**

2. **Prepare Borehole Profile from Caliper log.**

3. **Run CBL/GR log over 13-3/8″ surface casing.**

Equalize a cement plug in open hole from 4963' to 4700'.

1. **Run open-ended drill pipe to TD at 4963'.**

2. **Equalize 120 sacks Class G cement premixed 2% CaCl2, 1.25% Halad 322, 0.1% Super CBL (Cement amount includes 25% excess). POH. WOC for 4 hours.**

Run 12-1/4" bit and drill out cement and formation to top of Mokelumne River formation around 4730' MD=4681' VD.

1. **Run the following BHA: 12-1/4" RR bit (4-14/32" jets), 2 DC's, Stab., 3HW's, Jars, 27 Hw's, DP. RIH. Treat mud for cement contamination.**

2. **Drill out cement and formation to top of Mokelumne River Formation sands at ~4730' MD = ~4681' VD (determined from logs). Circulate and condition hole. Use both pumps. POH.**

Cleaning hole to run 9-5/8" long string casing.

1. **Ream and clean hole to ~4730' with the following BHA before running casing: 12-1/4″ RR bit (4-11/32″ jets), 12-1/4″ hole-opener with 3-11's jets, 6 point 12-1/4″ roller reamer, 3 HW's, Jars, 27 Hw's. Use both pumps.**

2. **Circulate well at high rate with both pumps before pulling out to run 9-5/8″ long string casing.**

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9-5/8″ Long String Casing and Cementing Program

Surface Casing: 13-3/8″, 54.5#, J-55 set at ~600′
Hole size: 12-1/4″ hole drilled to ~4730′ MD (4681′ TVD). MW=10 ppg
Note: This is a directional well with maximum inclination angle of ~20°.

1. **Run 700′ of 9-5/8″, 40#, N-80, LT&C, drifted to 8-3/4″ on bottom and 4002′ of 9-5/8″, 40#, J-55, LT&C, drifted to 8-3/4″ on top.**

2. **Run float shoe and float collar. Tack weld & Bakerlok bottom 4 collars (including shoe, and float). Modify last joint in hole so the bottom of casing is as close as possible to 4730′ MD.**

3. **Prepare tally sheets for the casing. E-mail tally to Irani Engineering.**

4. **Give Cementers 24 hours notice before running casing.**

5. **Use Tongs to run casing. Run fill-up and circulating tool. Clean threads. Visually inspect casing. Have slip type elevators. Please bring back up on tongs and elevators. Have welder on location while running casing. Have extra LT&C collar on location to weld on top joint if pipe stops off bottom. Have thread lubricant and apply to the casing on the rack.**

6. **Notify Wellhead company. 9-5/8″ tubing head should be 3000# X 3000#.**

7. **Place 20 double bow spring centralizer on top of first 20 joints in hole and one bow centralizer on top of each joint after that all the way to 600′ (total of 103 centralizers).**

8. **The cement top is calculated to be at surface.**

9. **Run long string casing to desired depth. Rig up cementing head with top plug in it. Have two lines to cementing head. Have 2 Elite pump trucks on location. Circulate casing clean. Do not work pipe.**

10. **Displace cement with fresh water. Have 4 vacuum trucks full of water on location. Mix and pump cement with 2 pump trucks (at least 8 bbl/min). Displace cement with 2 pump trucks (at least 18+ bbl/min).**

11. **Cement Mix: Pump 40 Bbl of mud flush ahead and cement casing shoe at ~4730′ MD with 980 sacks Light Cement premixed with 3% KCl, 0.4% Halad-322, 0.25 lb/sk Pheno Seal, 0.1% FWCA, 0.3% HR-7 (12.8 ppg, 1.48 Cf/sk, 7.63 gal water/sk), followed with 350 sacks Premium Cement premixed with 5% NaCl, 1.25% Halad-322, 0.5% Halad-344, 0.25 lb/sk Pheno Seal, 0.5% D-Air, 0.2% SuperCBL, (15.8 ppg, 1.18 Cf/sk, 4.92 gal water/sk). Ramp up cement density for the tail cement from 15.8 ppg to 16.2 ppg. Launch top plug. Displace with fresh water with 2 pump trucks as fast as possible (~18+ bbl/min). Bump top plug. Test casing to 3000 psig. Use two vacuum trucks for displacement (total displacement volume is ~355 bbls).**
    Note: The cement calculation is based on theoretical annulus volume plus 25%. The final cement volume will be based on Caliper log plus 20%.

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Install BOE. Run casing logs. Test BOE.

1. **Wait on cement for 8 hours. Remove BOE. Set slip and packing. Cut casing. Install 9-5/8″ tubing head (3000#). Install 3000# BOE.**

2. **After 20 hours WOC. Run 8-3/4″ Retip bit and scraper to the top of cement. Do not drill out top plug. POH. Run Segmented (Radial) Bond Log/NL/GR logs. Be prepared to pressure up to 1500 psi. Test BOE and casing to 2500 psig according to standing orders. Notify EPA to witness. Use Recorded chart for BOE and casing Test. Redo the test if the pressure drops more than 5%. Run a 8-3/4″ rental retip bit with 4-11/32" jets, 2DC's, Stab, 3 Hw's, jars, 27 Hw's and 4-1/2″ DP. Drill out float collar and clean hole to top of shoe. Change hole to clean 4% KCL water treated with polymer.**

Dill out shoe of 9-5/8″ long string casing. Drill 10′ into formation as directed. Prepare to perform SRT.

1. **Drill out shoe of 9-5/8″ long string casing. Drill 10′ into Mokelumne formation as directed with 4% KCl water treated with polymer Circulate hole and change hole to clean 4% KCl water. Store 4% KCl water treated with polymer in a separate tank for future use. Pull out.**

2. **Run open-ended drill pipe to 4700′- MD. Close pipe rams and bag. Install circulating head with a 2″ wing valve and 2″ top valve.**

3. **Rig up Wireline truck. Install lubricator on top of circulating head. Run digital pressure/temperature gauge with Surface reading inside drill pipe to 5′ below the top of Mokelumne Formation around 4735′ MD.**

4. **Have 1000+ bbls of clean filtered 4% KCl water available on location in Baker Tanks. Measure the weight of the fluid in PPG. Also measure the fluid viscosity.**

5. **Before the start of the SRT test make sure the hole is full with 4% KCl water. Record stabilized bottom hole pressure for 1/2 hour.**

6. **Move in two Halliburton pump trucks. Connect to drill pipe.**

Perform SRT

1. **Start the Step Rate Test**

   Step No. 1: pump at 2 bbls/minute rate, pump at constant rate for 30 min. and record surface and bottom hole pressures.

   Step No. 2: Increase rate by 2 bbl/min. Pump at constant rate for 30 min., record surface and bottom hole pressures.

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Step No. 3: Increase rate by 2 bbl/min. Pump at constant rate for 30 min., record surface and bottom hole pressures.

Subsequent Steps: Increase rate by 2 bbl/min for each step. Pump at constant rate for 30 min., record surface and bottom hole pressures. It is anticipated that approximately six to seven steps may be needed to meet the test objectives

2. **Plot the injection rates and pressures and evaluate the data in accordance with SPE Paper 16798 to determine the fracture pressure based on a break in slope. Continue additional rate steps until at least two, and preferably three, rate steps plot past the break in slope. If a break in slope is not evident, continue the test as long as is feasible and until a bottom hole pressure of at least 3200 psi is reached.**

3. **The size and duration of the rate steps may be adjusted as directed by the engineer and approved by EPA in order to meet the test objectives.**

4. **If possible, maintain the final rate step for at least 60 minutes in order to prepare for fall off pressure measurement. After the pumping period is completed, shut in the well for 12 hours before retrieving the pressure gauge.**

5. **Pull out drill pipe.**

Run Drilling BHA and drill 8-3/4″ hole to ~4772' MD = 4721′ TVD

1. **Run a 8-3/4″ rental retip bit with 4-11/32" jets, 2DC's, Stab, 3 Hw's, jars, 27 Hw's and 4-1/2″ DP. Using 4% KCl water treated with polymer drill to ~4772' MD = 4721' VD (40' vertical depth below top of Mokelumne Formation)**

2. **Wipe hole three times to above float collar. Circulate on bottom for at least 1 hour. POOH.**

Under Reaming and logging Program for 17″ open hole.

1. **Run an under-reamer and under ream the open hole to 17" from 4730′ MD to 4772′ MD.**

2. **Re-ream the hole three more times. Circulate on bottom at least for 2 hours. POOH.**

3. **Run bore hole caliper log from 4730′ MD to 4772′ MD.**

Mud logging Program

1. **Install mud loggers at shoe of conductor pipe ~60′. Circulate as necessary for evaluation. Open hole tests will not be run. Take one set W&D samples every 30'. E-mail daily log copies to PG&E, WorleyParsons, EPA, and Irani. Watch pit level monitor closely at all times. Keep 3 spliced log copies in trailer.**

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Mud Program

Aquagel/Polyac Plus mud system with low PH from 600′ to TD.

Depth	Weight	Viscosity	Water Loss
0'- 600′	Spud mud	65 sec.	NC
600′-3000'	9.0-9.8 ppg.	35-45 sec.	6cc/30 min
3000'- TD	9.8-10.0 ppg.	35-45 sec.	6cc/30 min

Have sufficient mud material on location to raise mud weight .66 ppg. Adjust mud weight to maintain mud log base line below 30 units and to stabilize shale.

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PG&E

King Island Test Well No. 1

Gravel Pack & Liner Program

TD ~4772' MD (4721′ VD)
Surface Casing: 13-3/8", 54.5#, J-55, cemented at ~600'.
Long String Casing: 9-5/8″ 40# J-55 & N-80 cemented at ~4730′ MD.
Open Hole: 17″ open hole, MW=8.4 ppg 4% KCl water
Drill Pipe: 4-1/2″, 16.6#, XH

1. Circulate clean. Pull to shoe. Wait one hour. Run in hole and check for fill.

2. Pull up to 100′ above the shoe of the 9-5/8″ casing. Rig up Baker DE Filtering Unit. Change hole over to clean filtered 4% KCL water.

3. Pull out of hole.

4. Pick up liner assembly consisting of:

~5′ 5-1/2″ Circulating Shoe with open hole centralizer
~57′ 5-1/2″ (~6″ OD) premium wire wrap Screen
~38′ 5-1/2″ Blank Pipe (1 jt 38′)
~35' 9-5/8″ Baker SC-1 Gravel Pack Tool with Sliding Sleeve, extensions setting and crossover tool
~135′ Tail Pipe and polished stinger for circulating shoe (to be run inside WWS)

Note: Centralize liner every 20′. Minimize the use of pipe dope. Apply to pin end only.

5. Run in with liner assembly on 4-1/2″ work string to desired depth around 4772' MD.

6. Rig up pumping equipment and lines.

7. Conduct safety meeting.

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8. Test lines to ~5000 psi. Drop ball.

9. Set and test gravel pack tools. Blow ball seat.

10. Using clean filtered 4% KCl, establish and record pump rate and pressure in reverse position.

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11. Clean tubing by performing a sand scour. With the crossover tool in the reverse position, pump a 5 bbl slurry of ~2 ppg sand down the work string to the reverse port in the crossover tool. Immediately reverse the slurry out off the work string. Keep pump rate as high as conditions allow. Inspect returns to see what material the scour may have removed from the work string.

12. Establish and record pump rate and pressure in circulating position and circulate hole clean. Un-sting from circulating shoe. Using Baker Gravel Infuser System gravel pack WWS. Begin infusing Baker Low Fine Ottawa Gravel into clean 4% KCl water at ½ lb/gal. Typical pump rates are 4-6 bpm. Once sand clears crossover tool then increase sand loading to maximum of 2 PPG as conditions allow. Continue pumping at this rate and concentration until wellhead pressure begins increasing. Pump rate should be reduced accordingly as well head pressure increases. Once pressure reaches 500 PSI over initial circulating pressure is achieved stop pumps. DO NOT RESTRESS PACK at this time.

13. Close annular BOP and apply 500 PSI to the annulus. Place the crossover tool in the reverse position. Reverse out excess gravel until returns are clean. Monitor and determine the volume of gravel reversed out. To test the gravel pack, lower crossover tool into the circulating position. Circulate at sand out rate and attempt to achieve sand out pressure established earlier. If same sand out pressure cannot be achieved, mix and pump another batch of gravel recommended by pump specialist. Repeat this step until final sand out occurs. POOH with service tools.

14. Have 3 500 bbl Baker Tanks full of clean 4% KCL. water on location during the gravel pack job. Have enough vacuum trucks on location to accomplish all the necessary water hauling.

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PG&E

King Island I/W Test Well No. 1

Tubing Program

1. **Pick up 5-1/2″, 17#, J-55, LT&C tubing. Pick up Baker seal assembly. X-over, Tendeka SPSRO Gauge Mandrel (4-1/2", 12.6# 41330 L-80 with Vam threads, SPSRO Pressure/Temperature Gauge should be inside Mandrel). Connect 1/4" A825 cable to Mandrel. Run X-0ver and the 5-1/2" tubing in hole with 1/4" cable attached to the outside of tubing and affixed to the tubing at every connection with 5-1/2" Cross Coupling Cable Protectors. Run in hole very slowly as not to damage cable. Install tubing hanger on top of tubing. Run 1/4" cable through the designated outlet in the tubing hanger. Secure bottom and top of outlet between cable and and outlet with Swagelok Fittings. Circulate through tubing and add corrosion inhabiting additives and biocide to the fluid. Land tubing hanger and stab into Baker Model SC packer at ~4637'. Install 3000# X-mas tree. There is an outlet through the flange above tubing hanger that the cable will pass through and will be sealed with Swagelok Fittings. Test annulus to 2500 psig to make sure the seal assembly is sealing inside packer. Test tree to 3000 psig.**

2. **Connect 1/4" cable to Junction Box.**

Annulus Mechanical Integrity Test

1. **Notify EPA. Pressure test 9-5/8″ X 5-1/2″ annulus with 2500 psig for 30 minutes. Use recordable pressure gauge for the testing (Halliburton SPIDR Dual crystal quartz gauge is a good option). Install pressure gauges on both tubing and annulus. Monitor tubing and annulus pressures during test. Redo the test if the pressure drops by more than 5%.**

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King Island I/W Test Well No. 1

Elevation: -3.75′ ground, USGS, +8.25' KB.

Anticipated Formation Tops

	Vertical Depth	Measured Depth
Top of Mokelumne River Formation	4681′	4730′
TD	4900′	4964′

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STANDING ORDERS, DRILLING & REMEDIAL OPERATIONS

Operator PG&E Well No. King Island I/W Test Well No. 1

Contractor Paul Graham Drilling Rig No. 7

***1. Prior to drilling out the surface casing, the blowout preventers and all associated equipment shall be pressure tested to 50% of the rated working pressure (Bag preventer to 40%). Equipment to be tested separately are: Pipe rams, blind rams, bag preventer, kelly cock, standpipe valve, kill line (stop valve, check valve) and blow down line (each valve, choke and bean). Blow down manifold shall have at least one operating pressure gage of a range at least 1000 psig higher than blowout preventer rated working pressure. EPA to witness.**
***2. Blowout preventers on protection and production casing shall be tested as above to 70% of rated pressure (Bag to 50%).**
***3. Each drilling crew is to have at least one blowout drill weekly.**
***4. Before tripping, check the ditch for flow with pumps off.**
***5. Daily record the one-half pump stroke standpipe pressure.**
6. Measure drill pipe on first trip after installing mud loggers.
7. All casing run shall be carefully visually inspected for pipe body and thread defects as it is unloaded. Casing shall not be permitted to drop from trucks, roll it off on ramps.
8. Protection and production casing shall be run with hydraulic tongs set to the proper torque for the casing being run. Pick up thread protectors shall be used.
9. All casing shall have threads "bright" cleaned and a Teflon pipe dope (Bakerseal, TF-17) liberally applied.
10. Keep hole full at all times.
***11. Check operation of BOE each round trip.**
12. Take all measurements from KB.
13. Drilling rig mud pits shall have a calibrated tank to gage mud used to fill the hole on trips.
14. Have a 1000 psig pressure gauge available on the floor.
15. Company man and tool pusher must sign tour sheet daily and note any downtime. Company man needs to note daily and monthly cumulative downtime on daily report.

Each 60' stand of 4-1/2" drill pipe takes 0.38 barrel.

***Shall be entered on tour sheet and signed by person in responsible charge.**
Date: December 07, 2013

IRANI ENGINEERING
PETROLEUM ENGINEER
2625 FAIR OAKS BLVD., SUITE 10
SACRAMENTO, CALIFORNIA 95864
916-482-2877
FAX 916-482-7514

PG&E

King Island Injection/Withdrawal Test Well No. 1

Location: X=1734880.641 Y= 577346.753 (NAD 27, Zone III)
Section 27, T 3N, R 5E, San Joaquin County, California.
Elevation: -3.75' ground. +8.25' KB (NGVD 29)

Take all measurements from KB which is 12' above ground.

Present Condition
TD:~4772' MD PD: ~4767' MD
Casing: 13-3/8", 54.5#, J-55 surface casing cemented at 600
9-5/8", 40#, J-55 & N-80 intermediate casing cemented at 4730'.
5-1/2" premium wire wrap liner gravel packed from 4710' to 4772'.
Tubing: 5-1/2", 15.5#, J-55, LT&C, thread with seal assembly stabbed into SC packer at ~4637'.
Note: A downhole permanent pressure gauge is above the seal assembly. There is ¼" cable that runs outside of tubing and it is affixed to the tubing with 5-1/2" Cross Coupling Cable Protectors at every connection. The cable goes through the outlets in the tubing hanger and tubing head top flange and is connected to an instrument junction box at surface.
Note: There is 4% KCL water in tubing. This well is directional with maximum angle of 20 degrees.

Completion Program

1. **Install two Baker Tanks (500 bbls each) on location. Install and stake a 3" steel line from the wing valve to a tank.**

2. **Move in 2-1/2" coil tubing truck on location. Run coil tubing to bottom of hole at around 4767'MD. Using Nitrogen unload completion fluid. Using Nitrogen induce formation water flow. Flow more than 300 Bbl of formation water. Perform field measurements for PH, conductivity, temperature, and TDS. Take 3 formation water samples and send to an EPA approved laboratory and analyze for Trace Metals, Major Anions and Cations, Alkalinity, Conductivity, Hardness, PH, and TDS, Specific Gravity (see II.E.1(a)), and Oil & Grease (per 40 CFR&136.3). The analysis should indicate the recovery of Mokelumne formation water.**

3. **During the injection/Withdrawal and shut in operations maintain 100 psig pressure (use Nitrogen) on the 9-5/8" X 5-1/2" annulus. Install electronic pressure gauges on both tubing and annulus (5-1/2" X 9-5/8") outlets. Monitor tubing pressure and annulus pressure continuously.**

April 4, 2014

Pacific Gas & Electric

San Joaquin County
Sec 27, T3N, R5E
_King Island I/W Test Well #1

Wellbore #1

Plan: Plan #2 (31-Oct-13)

Job No. Plan #2 (31-Oct-13)

Sperry Drilling Services

Combo Report

31 October, 2013

Well Coordinates: 577,346.75 N, 1,734,880.64 E (38° 04' 55.46" N, 121° 25' 15.96" W)
Ground Level: -6.00 ft

Local Coordinate Origin:	Centered on Well _King Island I/W Test Well #1
Viewing Datum:	rkbe (p) @ 6.00ft (Original Well Elev)
TVDs to System:	N
North Reference:	Grid
Unit System:	API - US Survey Feet

Version: 2003.14 Build: 82

HALLIBURTON

Plan Report for _King Island I/W Test Well #1 - Plan #2 (31-Oct-13)

Measured Depth (ft)	Inclination (°)	Azimuth (°)	TVD below System (ft)	Vertical Depth (ft)	Local Coordinates Northing (ft)	Local Coordinates Easting (ft)	Map Coordinates Northing (ft)	Map Coordinates Easting (ft)	Dogleg Rate (°/100ft)	Vertical Section (ft)	Comments
0.00	0.00	0.00	6.00	0.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
6.00	0.00	0.00	0.00	6.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	GL
100.00	0.00	0.00	-94.00	100.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
200.00	0.00	0.00	-194.00	200.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
300.00	0.00	0.00	-294.00	300.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
400.00	0.00	0.00	-394.00	400.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
500.00	0.00	0.00	-494.00	500.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
600.00	0.00	0.00	-594.00	600.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
700.00	0.00	0.00	-694.00	700.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
800.00	0.00	0.00	-794.00	800.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
900.00	0.00	0.00	-894.00	900.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,000.00	0.00	0.00	-994.00	1,000.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,100.00	0.00	0.00	-1,094.00	1,100.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,200.00	0.00	0.00	-1,194.00	1,200.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,300.00	0.00	0.00	-1,294.00	1,300.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,400.00	0.00	0.00	-1,394.00	1,400.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,500.00	0.00	0.00	-1,494.00	1,500.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,600.00	0.00	0.00	-1,594.00	1,600.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,700.00	0.00	0.00	-1,694.00	1,700.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,800.00	0.00	0.00	-1,794.00	1,800.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
1,900.00	0.00	0.00	-1,894.00	1,900.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,000.00	0.00	0.00	-1,994.00	2,000.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,100.00	0.00	0.00	-2,094.00	2,100.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,200.00	0.00	0.00	-2,194.00	2,200.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,300.00	0.00	0.00	-2,294.00	2,300.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,400.00	0.00	0.00	-2,394.00	2,400.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,500.00	0.00	0.00	-2,494.00	2,500.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,600.00	0.00	0.00	-2,594.00	2,600.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,700.00	0.00	0.00	-2,694.00	2,700.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,800.00	0.00	0.00	-2,794.00	2,800.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
2,900.00	0.00	0.00	-2,894.00	2,900.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
3,000.00	0.00	0.00	-2,994.00	3,000.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
3,100.00	0.00	0.00	-3,094.00	3,100.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
3,200.00	0.00	0.00	-3,194.00	3,200.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
3,300.00	0.00	0.00	-3,294.00	3,300.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
3,400.00	0.00	0.00	-3,394.00	3,400.00	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	
3,464.95	0.00	0.00	-3,458.95	3,464.95	0.00 N	0.00 E	577,346.75	1,734,880.64	0.00	0.00	Start Build 3.00
3,500.00	1.05	40.18	-3,494.00	3,500.00	0.25 N	0.21 E	577,347.00	1,734,880.85	3.00	0.32	
3,600.00	4.05	40.18	-3,593.89	3,599.89	3.65 N	3.08 E	577,350.40	1,734,883.72	3.00	4.77	
3,700.00	7.05	40.18	-3,693.41	3,699.41	11.04 N	9.32 E	577,357.79	1,734,889.96	3.00	14.45	

Plan Report for _King Island I/W Test Well #1 - Plan #2 (31-Oct-13)

Measured Depth (ft)	Inclination (°)	Azimuth (°)	TVD below System (ft)	Vertical Depth (ft)	Local Coordinates Northing (ft)	Local Coordinates Easting (ft)	Map Coordinates Northing (ft)	Map Coordinates Easting (ft)	Dogleg Rate (°/100ft)	Vertical Section (ft)	Comments
3,800.00	10.05	40.18	-3,792.28	3,798.28	22.40 N	18.91 E	577,369.15	1,734,899.55	3.00	29.31	
3,900.00	13.05	40.18	-3,890.25	3,896.25	37.69 N	31.83 E	577,384.45	1,734,912.47	3.00	49.34	
4,000.00	16.05	40.18	-3,987.03	3,993.03	56.89 N	48.04 E	577,403.64	1,734,928.68	3.00	74.46	
4,100.00	19.05	40.18	-4,082.36	4,088.36	79.92 N	67.49 E	577,426.68	1,734,948.14	3.00	104.61	
4,131.62	20.00	40.18	-4,112.17	4,118.17	88.00 N	74.31 E	577,434.75	1,734,954.95	3.00	115.18	Start 598.96 hold at 4131.62 MD
4,200.00	20.00	40.18	-4,176.42	4,182.42	105.87 N	89.40 E	577,452.62	1,734,970.04	0.00	138.57	
4,300.00	20.00	40.18	-4,270.39	4,276.39	132.00 N	111.47 E	577,478.75	1,734,992.11	0.00	172.77	
4,400.00	20.00	40.18	-4,364.36	4,370.36	158.13 N	133.54 E	577,504.88	1,735,014.18	0.00	206.97	
4,500.00	20.00	40.18	-4,458.33	4,464.33	184.26 N	155.60 E	577,531.01	1,735,036.25	0.00	241.17	
4,600.00	20.00	40.18	-4,552.30	4,558.30	210.39 N	177.67 E	577,557.14	1,735,058.31	0.00	275.37	
4,700.00	20.00	40.18	-4,646.27	4,652.27	236.52 N	199.74 E	577,583.27	1,735,080.38	0.00	309.58	
4,730.58	20.00	40.18	-4,675.00	4,681.00	244.51 N	206.49 E	577,591.26	1,735,087.13	0.00	320.03	Start 233.05 hold at 4730.58 MD - King Island I/W T1
4,800.00	20.00	40.18	-4,740.24	4,746.24	262.65 N	221.81 E	577,609.40	1,735,102.45	0.00	343.78	
4,844.44	20.00	40.18	-4,782.00	4,788.00	274.26 N	231.61 E	577,621.02	1,735,112.25	0.00	358.98	Gas/Water
4,900.00	20.00	40.18	-4,834.20	4,840.20	288.78 N	243.87 E	577,635.53	1,735,124.51	0.00	377.98	
4,963.63	20.00	40.18	-4,894.00	4,900.00	305.41 N	257.91 E	577,652.16	1,735,138.56	0.00	399.74	TD at 4963.63

Plan Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	Local Coordinates +E/-W (ft)	Comment
6.00	6.00	0.00	0.00	GL
3,464.95	3,464.95	0.00	0.00	Start Build 3.00
4,131.62	4,118.17	88.00	74.31	Start 598.96 hold at 4131.62 MD
4,730.58	4,681.00	244.51	206.49	Start 233.05 hold at 4730.58 MD
4,963.63	4,900.00	305.41	257.91	TD at 4963.63

Vertical Section Information

	Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (ft)	Origin +E/-W (ft)	Start TVD (ft)
TD		No Target (Freehand)	40.18	Slot	0.00	0.00	0.00

Plan Report for _King Island I/W Test Well #1 - Plan #2 (31-Oct-13)

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
0.00	4,963.63	Plan #2 (31-Oct-13)	MWD ISCWSA

Formation Details

Measured Depth (ft)	Vertical Depth (ft)	TVDSS (ft)	Name	Lithology	Dip (°)	Dip Direction (°)
4,844.44	4,788.00	4,782.00	Gas/Water		0.00	

Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
King Island I/W T1	0.00	360.00	4,681.00	244.51	206.49	577,591.26	1,735,087.13	38.083	-121.420
- plan hits target - Point									

North Reference Sheet for Sec 27, T3N, R5E - _King Island I/W Test Well #1 - Wellbore #1

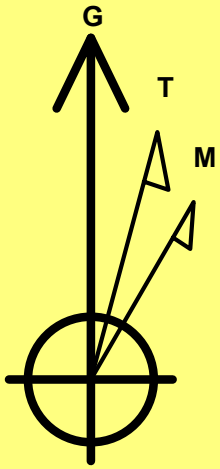
All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to Grid North Reference.
Vertical Depths are relative to rkbe (p) @ 6.00ft (Original Well Elev). Northing and Easting are relative to _King Island I/W Test Well #1

Coordinate System is US State Plane 1927 (Exact solution), California III 403 using datum NAD 1927 (NADCON CONUS), ellipsoid Clarke 1866
Projection method is Lambert Conformal Conic (2 parallel)
Central Meridian is -120.500°, Longitude Origin:0.000°, Latitude Origin:38.433°
False Easting: 2,000,000.00ft, False Northing: 0.00ft, Scale Reduction: 0.99994582

Grid Coordinates of Well: 577,346.75 ft N, 1,734,880.64 ft E
Geographical Coordinates of Well: 38° 04' 55.46" N, 121° 25' 15.96" W
Grid Convergence at Surface is: -0.56°

Based upon Minimum Curvature type calculations, at a Measured Depth of 4,963.63ft
the Bottom Hole Displacement is 399.74ft in the Direction of 40.18° (Grid).

Magnetic Convergence at surface is: -14.41° (29 October 2013, , IGRF2010)



Magnetic Model:	IGRF2010
Date:	29-Oct-13
Declination:	13.84°
Inclination/Dip:	61.70°
Field Strength:	49081

Grid North is 0.56° West of True North (Grid Convergence)
Magnetic North is 13.84° East of True North (Magnetic Declination)
Magnetic North is 14.41° East of Grid North (Magnetic Convergence)

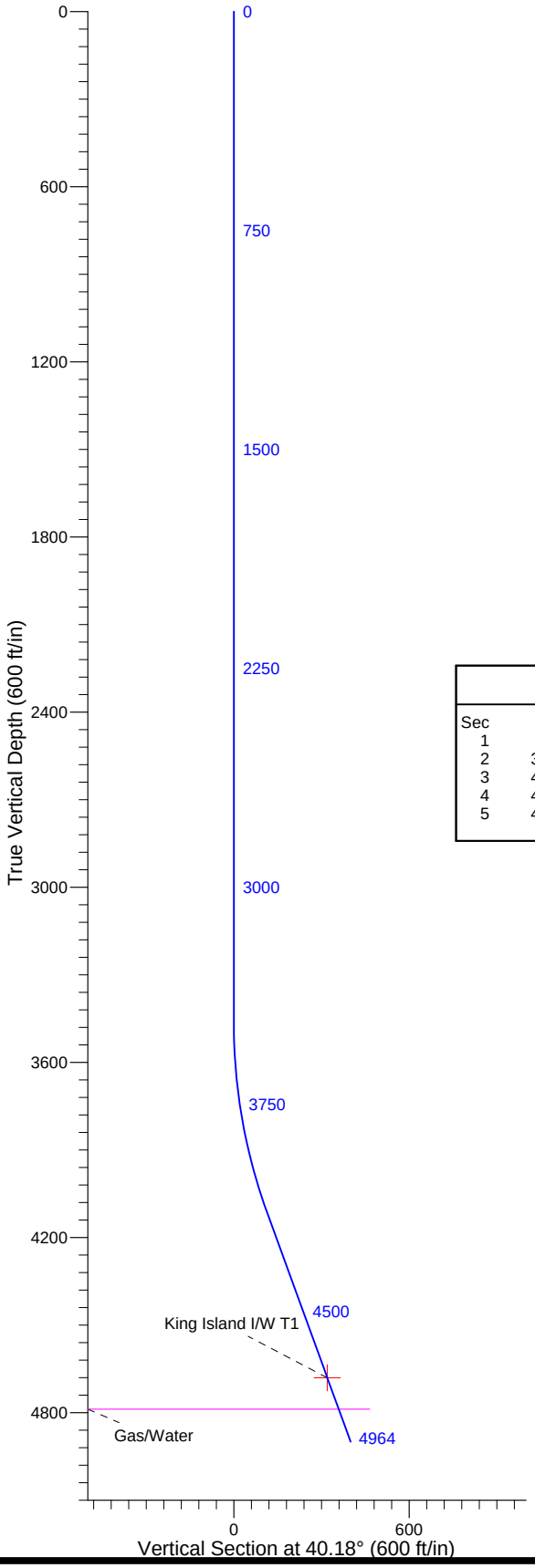
To convert a True Direction to a Grid Direction, Add 0.56°
To convert a Magnetic Direction to a True Direction, Add 13.84° East
To convert a Magnetic Direction to a Grid Direction, Add 14.41°

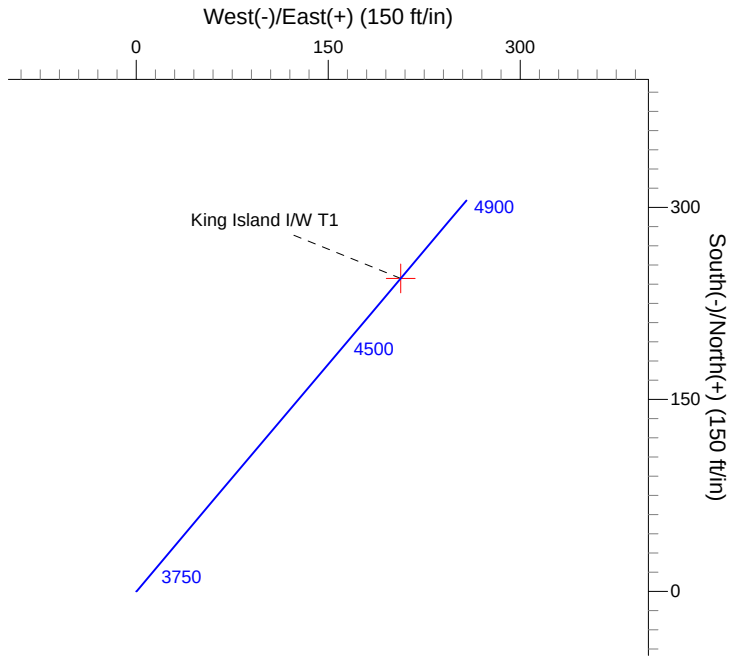
Azimuths to Grid North
True North: 0.56°
Magnetic North: 14.41°
Magnetic Field
Strength: 49080.6nT
Dip Angle: 61.70°
Date: 10/29/2013
Model: IGRF2010

Pacific Gas & Electric

Project: San Joaquin County
Site: Sec 27, T3N, R5E
Well: _King Island I/W Test Well #1
Wellbore: Wellbore #1
Design: Plan #2 (31-Oct-13)

HALLIBURTON
Sperry Drilling





SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	DLeg	TFace	VSec	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	3464.95	0.00	0.00	3464.95	0.00	0.00	0.00	0.00	0.00	
3	4131.62	20.00	40.18	4118.17	88.00	74.31	3.00	40.18	115.18	
4	4730.58	20.00	40.18	4681.00	244.51	206.49	0.00	0.00	320.03	King Island I/W T1
5	4963.63	20.00	40.18	4900.00	305.41	257.91	0.00	0.00	399.74	

_King Island I/W Test Well #1
NAD 1927 (NADCON CONUS)
California III 403
Grid
rkbe (p) @ 6.00ft (Original Well Elev)
Northing: 577346.75
Easting: 1734880.64

Pacific Gas & Electric
_King Island I/W Test Well - Plan #2 (31-Oct-13)r

MD	Inc	Azimuth	TVD	Subsea	Latitude	Northings	Departure	Eastings	Vert Sec	Dogleg
0.00	0.00	0.00	0.00	6.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
100.00	0.00	0.00	100.00	-94.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
200.00	0.00	0.00	200.00	-194.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
300.00	0.00	0.00	300.00	-294.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
400.00	0.00	0.00	400.00	-394.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
500.00	0.00	0.00	500.00	-494.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
600.00	0.00	0.00	600.00	-594.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
700.00	0.00	0.00	700.00	-694.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
800.00	0.00	0.00	800.00	-794.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
900.00	0.00	0.00	900.00	-894.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1000.00	0.00	0.00	1000.00	-994.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1100.00	0.00	0.00	1100.00	-1094.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1200.00	0.00	0.00	1200.00	-1194.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1300.00	0.00	0.00	1300.00	-1294.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1400.00	0.00	0.00	1400.00	-1394.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1500.00	0.00	0.00	1500.00	-1494.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1600.00	0.00	0.00	1600.00	-1594.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1700.00	0.00	0.00	1700.00	-1694.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1800.00	0.00	0.00	1800.00	-1794.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
1900.00	0.00	0.00	1900.00	-1894.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2000.00	0.00	0.00	2000.00	-1994.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2100.00	0.00	0.00	2100.00	-2094.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2200.00	0.00	0.00	2200.00	-2194.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2300.00	0.00	0.00	2300.00	-2294.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2400.00	0.00	0.00	2400.00	-2394.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2500.00	0.00	0.00	2500.00	-2494.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2600.00	0.00	0.00	2600.00	-2594.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2700.00	0.00	0.00	2700.00	-2694.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2800.00	0.00	0.00	2800.00	-2794.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
2900.00	0.00	0.00	2900.00	-2894.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
3000.00	0.00	0.00	3000.00	-2994.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
3100.00	0.00	0.00	3100.00	-3094.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
3200.00	0.00	0.00	3200.00	-3194.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
3300.00	0.00	0.00	3300.00	-3294.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
3400.00	0.00	0.00	3400.00	-3394.00	0.00	577346.75	0.00	1734880.64	0.00	0.00
3464.95	0.00	0.00	3464.95	-3458.95	0.00	577346.75	0.00	1734880.64	0.00	0.00
3500.00	1.05	40.18	3500.00	-3494.00	0.25	577347.00	0.21	1734880.85	0.32	3.00
3600.00	4.05	40.18	3599.89	-3593.89	3.65	577350.40	3.08	1734883.72	4.77	3.00
3700.00	7.05	40.18	3699.41	-3693.41	11.04	577357.79	9.32	1734889.96	14.45	3.00
3800.00	10.05	40.18	3798.28	-3792.28	22.40	577369.15	18.91	1734899.55	29.31	3.00
3900.00	13.05	40.18	3896.25	-3890.25	37.69	577384.45	31.83	1734912.47	49.34	3.00
4000.00	16.05	40.18	3993.03	-3987.03	56.89	577403.64	48.04	1734928.68	74.46	3.00
4100.00	19.05	40.18	4088.36	-4082.36	79.92	577426.68	67.49	1734948.14	104.61	3.00
4131.62	20.00	40.18	4118.17	-4112.17	88.00	577434.75	74.31	1734954.95	115.18	3.00
4200.00	20.00	40.18	4182.42	-4176.42	105.87	577452.62	89.40	1734970.04	138.57	0.00
4300.00	20.00	40.18	4276.39	-4270.39	132.00	577478.75	111.47	1734992.11	172.77	0.00
4400.00	20.00	40.18	4370.36	-4364.36	158.13	577504.88	133.54	1735014.18	206.97	0.00
4500.00	20.00	40.18	4464.33	-4458.33	184.26	577531.01	155.60	1735036.25	241.17	0.00
4600.00	20.00	40.18	4558.30	-4552.30	210.39	577557.14	177.67	1735058.31	275.37	0.00
4700.00	20.00	40.18	4652.27	-4646.27	236.52	577583.27	199.74	1735080.38	309.58	0.00

4730.58	20.00	40.18	4681.00	-4675.00	244.51	577591.26	206.49	1735087.13	320.03	0.00
4800.00	20.00	40.18	4746.24	-4740.24	262.65	577609.40	221.81	1735102.45	343.78	0.00
4900.00	20.00	40.18	4840.20	-4834.20	288.78	577635.53	243.87	1735124.51	377.98	0.00
4963.63	20.00	40.18	4900.00	-4894.00	305.41	577652.16	257.91	1735138.56	399.74	0.00

ATTACHMENT L-2

IRANI ENGINEERING, INC.
PETROLEUM ENGINEER
2625 FAIR OAKS BOULEVARD, SUITE 10
SACRAMENTO, CALIFORNIA 95864
916-482-2847
FAX 916-482-7514

Princeton Natural Gas, LLC

Piacentine No. 1-27

Location: 3490' North and 990' East from southwest corner of Section 27, T 3N, R 5E, MDB&M, San Joaquin Co., California.
Elevation: -6' ground, USGS. +7' KB.

Take all measurements from KB which is 13' above ground.
Keep hole full at all times.
Check operation of BOE daily

Present Condition (Producing)

TD 4900' MD PD: 4715' (bridge plug)
Casing: 8-5/8", 24#, J-55, cemented to surface @ 627'.
5-1/2", 15.5#, K-55, cemented at 4900'. Top of cement in the annulus is at 4175'.
Tubing: 2-3/8", 4.7#, J-55, EUE tubing hung at 4587'
Perforations: 4670'-4682'. Open
4684'-4690', 4700'-4705'. Cement squeezed.
4720'-4724', 4750'-4764'. Cement squeezed, Below bridge plug at 4715'.
Base of freshwater: ~150' (per Division of Oil & Gas).

Conversion program to an observation well

1. **Move in workover rig. Kill well with 4% KCl water treated with polymer. Install BOE and test. Notify EPA to witness, and if EPA requires, notify DOG to witness. Pressure test BOE to 2500 psig for 1 hour. Use recorded Chart for BOE test.**
2. **Pull out with tubing. Run mill and scraper to 4715'. Reverse hole clean. Pull out.**
3. **Run TMD (pulse Neutron)/GR/Collar located log from 4500' to 4715'.**
4. **Run Model R packer on bottom of tubing with Model R nipple above the Packer and a re-entry sub below the packer. Set packer at 4650'. Pressure test annulus to 2500 psig for 1 hour. Use recorded chart for this test. Notify EPA to witness.**
5. **Install X-mas tree. Test tree to 3000 psig.**
6. **Install pressure and temperature gauges on both tubing and casing sides.**
7. **Pressurize the annulus with 100 psig nitrogen. Monitor tubing and casing pressures on continuous bases.**
8. **Turn well over to operator as an observation well.**

6/25/2014

ATTACHMENT L-2

PG&E

6/25/2014

Piacentine 1-27 (API No. 077-20484) Conversion to Observation Well WBD

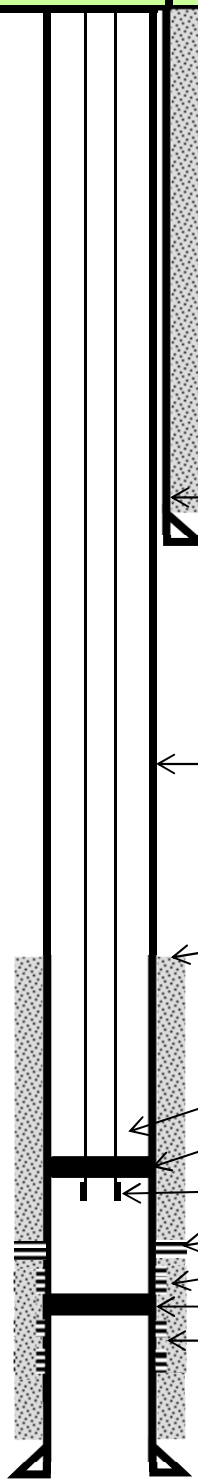
San Joaquin, California

Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -6' ground, +7' KB. All the measurements are from KB which is 13' above ground.

Installation	Depth & Description (after Planned Completion)	OD	ID
	Conductor		
	8-5/8", 24# J-55 Casing at 627' (Cemented to Surface)	8-5/8"	8.097"
	5-1/2", 15.5#, K-55, LT&C Casing set at 4900'	5-1/2"	4.950"
	Top of cement in annlus is at 4175'.		
	2-3/8", 4.7#, J-55 EUE tubing		
	Model R Packer at 4650'		
	Re-entry sub		
	Perforations from 4670'-4682'. Open		
	Perforations from 4684'-4690', 4700'-4705'. Cement squeezed		
	Bridge plug at 4715'		
	Perforations from 4720'-4724', 4750'-4764'. Cement squeezed		
	PD=4715'		
	TD=4900'		



ATTACHMENT M

Construction Details

CONTENTS

Section M-1 Requirements

Section M-2 Approach

Attachment M-1 Injection/Withdrawal Well Construction Details

Attachment M-2 Injection/Withdrawal Well Wellhead Detail

Attachment M-3 Monitoring Well (Piacentine 1-27 and Piacentine 2-27) Construction Details

M.1 REQUIREMENTS

Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.

M.2 APPROACH

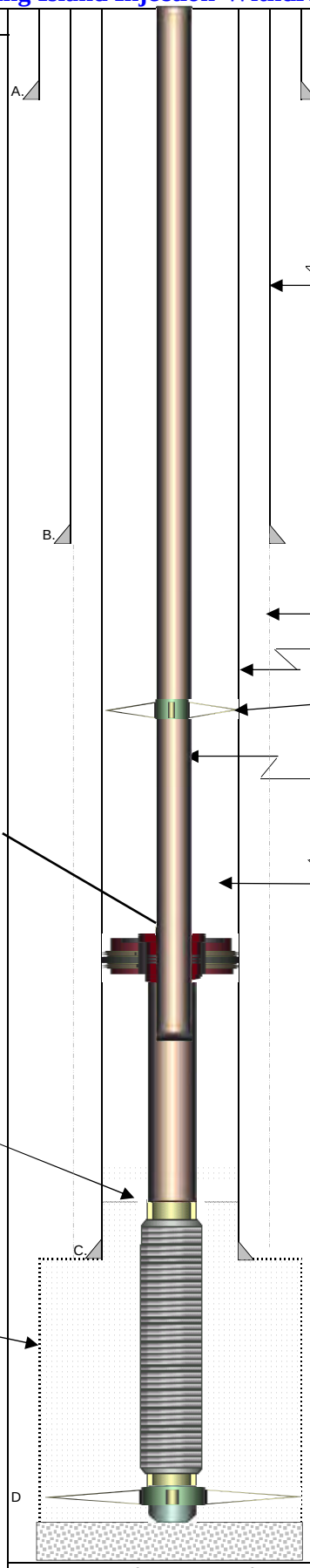
The proposed construction details for the Injection/Withdrawal Well are provided as a schematic drawing in Attachment M-1. Surface completion (wellhead) details are provided as a schematic drawing in Attachment M-2. Wellhead specification are summarized in Attachment L. The proposed construction details for the monitoring wells (Piacentine 1-27 and Piacentine 2-27) are provided as schematic drawings in Attachment M-3.

ATTACHMENT M-1 - CONSTRUCTION DETAILS

King Island Injection-Withdrawal Test Well No. 1

PG&E

WELL COMPLETION DIAGRAM



COMMENTS	EQUIPMENT DESCRIPTION
	20" Casing @ 60' cemented to surface
	13-3/8#, 54.5#, J-55 ST&C
	13-3/8" Casing @ 600' cemented to Surface
	12-1/4" Hole
	9-5/8, 40#, J-55 LT&C
	Centralizer (typical, see program description)
	1. Tubing, 5-1/2", 15.5#, J-55, LT&C @ 4637' (Including BH pressure gauge adapter. 1/4" cable is clamped to the side of tbd.)
	9-5/8" X 5-1/2" annulus is filled w 4% KCL water plus corrosion inhibitor and biocide.
	2. Baker SC-1 Packer Top @ 4637'
	3. Upper Extension
	4. Sliding Sleeve
	5. Seal Bore
	6. Lower Extension
	7. Blank 5-1/2", 17#, N-80
	9-5/8" Casing @ 4,730' MD =4681' VD Cemented to surface
	8. 5-1/2" premium wire wrap screen (6" OD)
	9 O-ring seal sub
	10 Circ Shoe & Centralizer
	11 Total depth at 4772'MD = 4721' VD

FIELD	NA		
WELL #	King Island Test Well No. 1		
Ground MSL -6'	-3.75		
KB	8.25'		
LOCATION	Sec. 27, T 3N, R 5E, MDB&M		

DIRECTIONAL DATA

MAX ANGLE	20	THRU ZONE	4772'
KOP	3465'	HOLE TYPE	Directional
BH Location	Vertical	255' N & 215' E	

SURFACE EQUIPMENT

TREE	3" 3M
SWAB CAP SIZE & THRD	8rd EUE lift thread
TOP TREE FLANGE	5" 3M
TUBING SPOOL FLANGE	11" 3M

TUBING DETAIL

	1st or LS	SS or Btm of Taper
SIZE	5-1/2"	
WEIGHT	15.5#	
GRADE	J-55	
DEPTH	4637'	
THREAD	LT&C	
NEW/USED	NEW	
COATING	None	
SCSSV	None	
Min. I.D.	4.825"	

	O. D. (in.)	I. D. (in.)	LENGTH (ft)	DESCRIPTION
1.	5-1/2"	4.825"	4637'	5-1/2", 15.5#, J-55
2.	8"	5"	5'	Baker SC-1 Packer
3.	5.5"	4.892	6'	Upper Extension
4.	5.81"	4.892	2'	Baker Model S Sliding Sleeve
5.	5.56"	4.892	1'	Baker Seal Bore
6.	5.56"	4.892'	17'	Lower Extension
7.	5.5"	4.892	38'	Blank 5-1/2", 17#, N-80
8.	6"	4.892	62'	51/2" Wire wraped screen
9.	5.5"	1.813"	2.71	O-ring seal sub
10.	5.5"	N/A	1.80	shoe
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				

CASING DETAIL

#	SIZE	WGHT	GRADE	THRD	DEPTH (MD)
A	20"	53#	NA		0' - 60'
B	13-3/8"	54.5	J-55	LT&C	0' - 600'
C	9-5/8""	40#	J&N	LT&C	0' - 4,730'
D	5-1/2"	17#	N-80	LT&C	4637'-4772'
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					

Prepared By:	Saeed Irani	Date	Nov. 11, 2013
Updated By:	Saeed Irani	Date	November 21, 2013
		Printed on	January 4, 2014

PBTD: 4772' MD 4721' TVD

TD: 4772' MD 4721' TVD

Completed:

File: J:\Project Active\WorleyParsons PGE CAES\SOPO 1.4 Task 3.7.4 Core Well UIC Permitting\UIC Application Report\December 2013\Attachment M - Construction Details\[Att M-1 Test Well No 1 Schematic 21-Nov-13.xls]Actual WBD

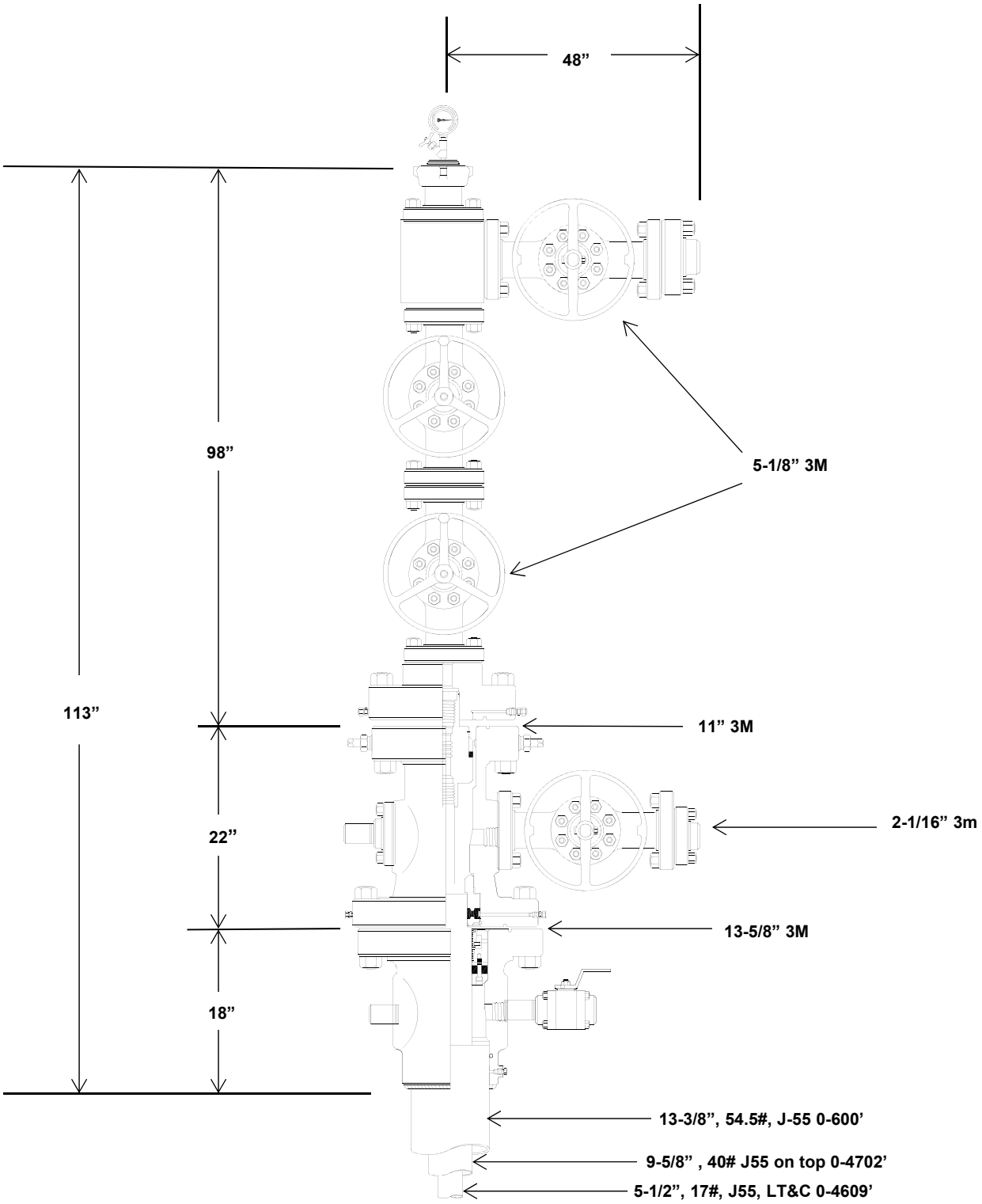
ATTACHMENT M-2

CAMERON

PG & E

King Island I/W Test Well No. 1

3000 psi completion



ALL DIMENSIONS ARE ESTIMATES

Q3838

ATTACHMENT M-3

PG&E

6/25/2014

Piacentine 1-27 (API No. 077-20484) Conversion to Observation Well WBD

San Joaquin, California

Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -6' ground, +7' KB. All the measurements are from KB which is 13' above ground.

Installation	Depth & Description (after Planned Completion)	OD	ID
	Conductor		
	8-5/8", 24# J-55 Casing at 627' (Cemented to Surface)	8-5/8"	8.097"
	5-1/2", 15.5#, K-55, LT&C Casing set at 4900'	5-1/2"	4.950"
	Top of cement in annlus is at 4175'.		
	2-3/8", 4.7#, J-55 EUE tubing		
	Model R Packer at 4650'		
	Re-entry sub		
	Perforations from 4670'-4682'. Open		
	Perforations from 4684'-4690', 4700'-4705'. Cement squeezed		
	Bridge plug at 4715'		
	Perforations from 4720'-4724', 4750'-4764'. Cement squeezed		
	PD=4715'		
	TD=4900'		

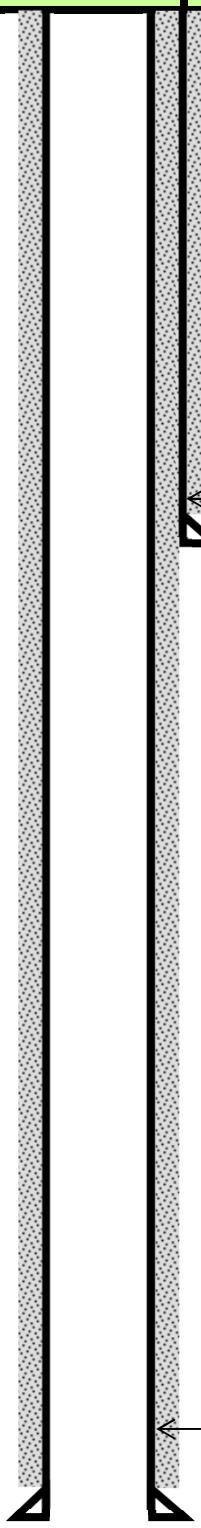
Attachment M-3

PG&E

Piacentine 2-27 (API No. 077-20736)
San Joaquin, California
Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation & KB (12'): +6'

Installation		Depth & Description (after Planned Completion)	OD	ID
		Conductor at 60'		
		9-5/8", 36# J-55 STC Casing at 614' (12-1/4" hole) (Cemented to Surface with 280 Sacks)	9-5/8"	8.921"
		5-1/2", 15.5#, J-55, LT&C Casing set at 4969' (Cemented to Surface with 1180 Sacks)	5-1/2"	4.950"
		TD=4970'		

ATTACHMENT N

Changes in Injected Fluid

CONTENTS

Section N-1 Requirements

Section N-2 Description of Injection Program and Injectate

N.1 REQUIREMENTS

Discuss expected changes in pressure, native fluid displacement, and direction of movement of injection fluid.

N.2 DESCRIPTION OF INJECTION TESTING PROGRAM AND INJECTATE

The compression testing program involves building an approximately 0.5 billion standard cubic feet (Bscf) air bubble in a depleted (water-invaded) gas reservoir in the uppermost sands of the Mokelumne River Formation at the King Island gas field, and then performing a series of tests, currently conceived to include injection, withdrawal and pressure fall-off and build-up tests (Attachment H). The proposed volume of the air bubble represents approximately 4% of the original gas in place prior to gas production in the field. It will be formed in reservoir sands at the uppermost part of a permeable sandstone lobe in the eastern portion of the field that is enclosed laterally by shale deposited in the Meganos Channel and capped by shale of the Capay Formation (Attachments G and F). The air bubble will be created by injecting oxygen-depleted air through a single proposed Injection-Withdrawal Well at flow rates of up to approximately 14 MMscfd and pressures not exceeding 2,200 psi at the well head and 2,500 psi at the bottom of the well. Withdrawal testing will occur periodically at flow rates ranging from 15 to 45 MMscfd (Attachment H). The flow episodes will range in duration from approximately four up to approximately 10 hours. At the conclusion of the test, additional withdrawal testing will be conducted with ambient air to the extent feasible and as long as all safety criteria can be met, to decrease the volume of the air bubble and decrease reservoir pressure.

The conceptual compression testing program is described as follows. During the first 10 days of the bubble-building injection period, the air injection rate will be ramped up slowly to the long-term rate of up to about 14 MMscfd in order to manage pressure during the initial water displacement. Injection will continue at the long term rate for approximately 34 days until the air bubble is of a sufficient size to meet the pilot testing objectives. The injected air will displace formation water and formation pressures will increase during this time period as water flows away from the injection zone. As pressures rise, the air bubble will be compressed, as will the small amount of free or "movable" natural gas that remains in place at the top of the reservoir (the attic gas), and the gas bubbles that are trapped in the formation matrix in the portion of the reservoir that was originally gas-filled but has become invaded by water.

Modeling described in Attachment A, Section A.4.1, indicates that maximum pressures are expected to be experienced at the end of the 44-day bubble building period. At the Injection/Withdrawal Well, the maximum bottomhole pressures are expected to be approximately 2,350 to 2,450 pounds per square inch, and worst case pressures have been estimated at 2,500 psi.[1] This corresponds to a maximum

[1] Predicted maximum bottomhole pressures for the realistic conservative case (Sh/Kl) described in Attachment A are approximately 2,450 psi. Predicted maximum bottomhole pressures for the worst case assumptions (Sl/Kl) are approximately 2,500 psi; however, this case neglects the compressibility of existing trapped gas in the water-invaded zone of the reservoir and is not considered realistic. It is provided as an upper-bound number for perspective.

expected pressure increase of approximately 440 to 550 psi above the ambient reservoir pressure at the Injection/Withdrawal Well. Because existing ambient reservoir pressure is approximately 150 psi below the normal hydrostatic gradient due to gas production activities (Attachment C), expected bottomhole pressures at the Injection/Withdrawal Well are predicted to be approximately 290 to 400 psi above normal hydrostatic pressures.

The predicted pressures decrease with distance from the Injection/Withdrawal Well. Predicted pressures at the four wells located in the Area of Review are shown graphically in Attachment C-2. The expected pressure increase (Sh/Kl scenario) at the Piacentine 1-27 well is approximately 235 psi (approximately 100 psi above the normal hydrostatic gradient), and the expected pressure increase at the Moresco et al. Unit A 1 (Moresco) well is predicted to be 160 psi (4 psi above the normal hydrostatic gradient).

After the bubble building phase of the proposed compression test, pressures will vary as a result of repeated injection and withdrawal test cycles; however, the overall trend is expected to be a decrease in pressure due to an overall net shrinkage in the injected air volume. Pressures would again increase if an ambient air injection testing phase is implemented, but would drop off rapidly during subsequent withdrawal cycling. The predicted pressure trends at the AOR well shown in Attachment C-2 show pressures dropping below normal hydrostatic pressures within a relatively short time after the conclusion of the compression test. It is important to note that these predictions were made using a "superposition modeling" approach, which predicts only the change from existing conditions induced by the proposed project. The effect of existing pressure gradients in the reservoir sands and the underlying aquifers was not considered, and could increase the amount of time required for pressures to dissipate. However, the model also did not consider that during Phase 4 and 5 of the project, additional withdrawal testing will be conducted to the extent feasible and to the extent that safety criteria can be met. This additional withdrawal testing will decrease the remaining air volume and the residual pressures in the formation.

The average expected pressure increase in the vicinity of the air bubble[2] is predicted to be up to approximately 2,300 psi. The air bubble that will be created is estimated to extend to a maximum distance of approximately 600 feet from the Injection/Withdrawal Well (Attachment A, Section A.3). During the bubble building phase, the injected air will tend to first displace the water and any remaining native gas around the well and then rise to the top of the reservoir, impinging on the caprock. The bubble will then spread laterally in all directions and downward. Air will travel preferentially through more permeable zones, producing an irregular lateral (and to some extent vertical) boundary to the bubble. Most of the free water saturating the formation around the injection well will be pushed away during injection, with a certain amount of residual saturation remaining behind in capillary tension (estimated to be approximately 35%). During withdrawal, a smaller portion of free water may re-enter the well and flow to the surface as produced water and water vapor in the withdrawal air stream. Some

[2] Taken as the average of the predicted pressure increase at the Injection/Withdrawal Well and the Piacentine 1-27 well under modeling scenario Sh/Kl (Attachment C-2).

of the residual water bound by capillary forces in the "dehydration zone" immediately surrounding the wellbore will be evaporated as drying of the formation progresses, but this process is not expected to progress significantly during the relatively short duration of the test.

As discussed in Attachment G, the water-invaded reservoir sands of the King Island gas field occur at the top of an erosional remnant surrounded by low permeability shale deposited in the Meganos Channel that form a barrier to lateral flow. The reservoir sands are underlain by a relatively low permeability sequence of shale and siltstone that acts as an aquitard to attenuate vertical flow. As air is injected into the King Island gas reservoir, the displacement of natural gas and water will cause pressures within the water-invaded gas reservoir sands in the uppermost portion of the King Island erosional remnant to increase. The increase in pressure will cause water to flow slowly out of the reservoir through the underlying shale and siltstone and into the underlying aquifer sequence. The displacement and outflow of water from the reservoir sands will propagate downwards through the sequence of sandstone aquifers and intervening siltstone and shale aquitards, until it reaches the thick aquitard sequence in the lowermost portion of the Mokelumne River Formation, within which it will propagate laterally. In addition, water flow and pressure will take place laterally in each aquifer until it reaches the relatively impermeable shales deposited at the edge of the Meganos Channel (assuming, as is likely, that these act as barriers to water flow and pressure propagation).

The pressure increase in the two uppermost aquifer sequences underlying the reservoir sands was simulated using a numerical model as discussed in Attachment A. The maximum expected pressure increase (Sh/Kl case) in the uppermost aquifer beneath the reservoir sands is approximately 40 to 65 psi, well below the normal hydrostatic pressure. The worst case pressure increase is reported as approximately 100 to 150 psi, at or below normal hydrostatic pressure.

ATTACHMENT O

Plans for Well Failures

CONTENTS

Section O.1 Requirements

Section O.2 Plan for I/W Well Failure

Section O.3 Plan for Monitoring Well Failure

O.1 REQUIREMENTS

Outline contingency plans to cope with all shut-ins or well failures so as to prevent migration of fluids into any USDW.

O.2 PLAN FOR I/W WELL FAILURE

The proposed Injection/Withdrawal Well will be used to inject compressed air (rather than fluid) into the target injection zone in a depleted (water-invaded) gas reservoir. As such, the following summarizes the plan to address failure of the well to protect the surface environment and prevent migration of fluids into any USDW:

- The injection well will not be used until the initial mechanical integrity test is passed.
- Monitoring and periodic routine investigative procedures will be performed during operation as required under the permit, and as outlined in Attachments H, K and P. Pertinent data will be reviewed regularly by qualified operators and reported to EPA monthly. The monitoring and testing program has been designed to assure well integrity and safe operation.
- As described in Attachment K, the well and process data sensors will be connected to a hybrid data acquisition, control and safety system. The system will include an Emergency Shut Down/Fire and Gas System (EGS/FGS), and Programmable Logic Control (PLC). The system will be programmed with safety and compliance shut down interlocks that stop the injection and flow process and shut in the well using an automated control valve in the event of :
    - A high pressure condition that exceeds the allowable injection pressure;
    - Rapid injection pressure falloff;
    - Rapid annular pressure falloff;
    - High temperature;
    - High hydrocarbon vapor;
    - Higher than design oxygen content;
    - Fire;
    - A manual trip; and
    - Power failure.
- In addition, audible alarms will be triggered at shut down and at below-shutdown thresholds for high hydrocarbon vapor or low oxygen content.

- EPA will be notified within 24 hours of any control system-initiated shutdowns triggered by a compliance issue or an issue that could impact safety or the environment (USDW).
- If the well fails required continuous monitoring or periodic testing standards, the well will be immediately shut-in and EPA will be notified within 24 hours in accordance with applicable regulations and permit conditions. After investigation into the cause for the failure, work plans for repairing the problem will be prepared and submitted to EPA for approval prior to implementation.
- If a system interruption, upset, or emergency occurs, the well will be shut in and contingency plans will be implemented. These contingency plans will be prepared by the contractor retained by PG&E to design, build and operate the compression testing equipment. The plans can be provided to EPA once the contractor's engineering, process safety, and hazard and operability review processes are sufficiently advanced to finalize the plans.
- If a workover is performed on the well, mechanical integrity testing will be conducted as required by applicable regulations before the well is returned to service. Copies of all work reports and logs will be forwarded to EPA per applicable requirements.
- During the period of time the well is shut in or workovers are being performed, injection/withdrawal operations will be suspended until appropriate testing has been performed and approved by EPA.
- Should the mode of failure be beyond the limits of economic feasibility to repair, the guidelines for plugging and abandonment in Attachment Q will be followed.

O.3 PLAN FOR MONITORING WELL FAILURE

The proposed Piacentine 1-27 monitoring well is expected to become pressurized and could be subject to potential failures. The Piacentine 2-27 monitoring well is cemented and cased to the surface and is not perforated, and therefore is not expected to become pressurized. The following summarizes the plan to address failure of a monitoring well to protect the surface environment and prevent migration of fluids into any USDW:

- Monitoring and periodic routine investigative procedures will be performed during operation as required under the permit, and as outlined in Attachments H, K and P. Pertinent data will be reviewed regularly by qualified operators and reported to EPA monthly. The monitoring and testing program has been designed to assure well integrity and safe operation. The primary monitoring parameter for the Piacentine 1-27 monitoring well will be the annular pressure.
- If the monitoring well fails required continuous monitoring or periodic testing standards, the monitoring well and Injection/Withdrawal Well will be immediately shut-in and EPA will be notified within 24 hours in accordance with applicable regulations and permit conditions. After

investigation into the cause for the failure, work plans for repairing the problem will be prepared and submitted to EPA for approval prior to implementation.

- Should the mode of failure be beyond the limits of economic feasibility to repair, the guidelines for plugging and abandonment in Attachment Q will be followed.

ATTACHMENT P

Monitoring Program

CONTENTS

Section P.1 Requirements

Section P.2 Analysis of Injected Fluids

Section P.3 Monitoring Recording of Injection Pressures, Injection Flow Rates and Annular Pressures

Section P.4 Mechanical Integrity Testing

Section P.5 Monitoring and Reporting

Section P.6 Record Keeping

Table P-1 Chemical Sensor Instrumentation Specifications

Table P-2 Sampling and Analysis Requirements

Table P-3 Sample Collection and Handling Procedures

Table P-4 Pressure, Temperature and Flow Sensor Instrumentation Specifications

P.1 REQUIREMENTS

The monitoring requirements under 40 CFR 146.13 include the following.

- Analysis of injected fluids with sufficient frequency to yield representative data;
- Installation and use of continuous recording devices to monitor injection pressure, flow rate and volume, and the pressure on the annulus between the tubing and the long string of casing;
- A demonstration of mechanical integrity pursuant to Part 146.8 at least once every five years during the life of the well; and
- The type, number, and location of wells within the AOR to be used to monitor any migration of fluids into, and pressure in, USDWs, parameters to be measured and frequency of monitoring.

Monthly reporting requirements include:

- The physical, chemical and other relevant characteristics of injection fluids;
- Monthly average, maximum and minimum values for injection pressure, flow rate and volume, and annular pressure;
- The results of other required monitoring;
- Results of mechanical integrity tests;
- Any other test of the injection well conducted by the permittee, if required by EPA; and
- Any well rehabilitation or work-over activities.

P.2 ANALYSIS OF INJECTED FLUIDS

As described in Attachment K, the injection and withdrawal flow streams will be monitored continuously by redundant oxygen and combustible gas meters, and the results recorded every 30 seconds. Summary specifications for the sensors to be used are presented in table P-1.

TABLE P-1: CHEMICAL SENSOR INSTRUMENTATION SPECIFICATIONS

Location	Equipment	Instrument Type	Model	Precision	Accuracy	Features/Remarks
I/W Manifold near Wellhead	Hydrocarbon Analyzer 1	FID on slip stream	Baseline Modcon Series 9000	± 1% full scale	± 1% full scale	Programmable automatic or manual calibration.

Location	Equipment	Instrument Type	Model	Precision	Accuracy	Features/Remarks
I/W Manifold near Wellhead	Hydrocarbon Analyzer 2	IR Detector on slip stream	Hitech Inst. IR600 series	±2 % @ span	±2.5% of f.s.d.	Complete package with in-built pump, on-board filter, temperature and pressure correction over ambient ranges.
I/W Manifold near Wellhead	Oxygen Sensor	Zirconia sensor	Sensotec Rapidox 2100ZF	± 0.5%	± 1%	Range is <1 ppm to 100% O_2. Response time 1 to 4 seconds for a 90% response to a step change in gas compositions. Calibration using 2 or 3 user selectable gas mixtures (air is default)

Notes:
Instrument model, precision and accuracy shall be as specified or equivalent
I/W = Injection/Withdrawal
RTD = Resistance Temperature Detector
FID = Flame Ionization Detector
IR = Infrared
ppm = parts per million
LCD = Liquid Crystal Display

Injection gas samples will be collected from a sampling port in the injection/withdrawal pipe manifold near the wellhead at startup and end of the initial bubble build period with oxygen-depleted air (Phase 1), and again at the startup and end of air injection, if conducted (Phase 5). Withdrawal gas samples will be collected from the sampling port at the beginning and end of each flow test sequence during Phase 3 and 5. (See Attachment H for a detailed description of the proposed injection and withdrawal tests and phases.) In addition, grab samples of injection and/or withdrawal gas will be collected weekly and screened using portable field analyzers. Additional sampling will include vent stack samples for air emissions compliance monitoring, and sampling of produced water. The planned sampling and analysis activities are summarized in Table P-2.

TABLE P-2: SAMPLING AND ANALYSIS REQUIREMENTS

Sampling Area	Sampling Location	Sampling Frequency	Sample Matrix	Sampling Method	Laboratory Analysis								Field Instrument Analysis							
					Air/ Gas			Water					Air				Water			
					Hydrocarbon Gases (C_1-C_6)	Total hydrocarbon vapors as Methane	Fixed gases (O_2, N_2, CO_2, Ar)	CAM 17 Metals	TPPH	TEPH	Major Cations/Anions	General Minerals	LEL	Total hydrocarbon vapors as Methane	O_2	H_2S	pH	Temp	Specific Conductance	Turbidity
Injection/ With-drawal Pipeline Manifold	Gas Sampling Port	Daily during injection	N_2	Grab											X					
		Daily during flow	Gas	Grab									X	X	X	X				
		At Startup, End of Bubble Build	N_2	Summa			X													
		Start/End of Flow Tests	Gas	Summa	X	X	X						X	X	X	X				
Test Separator	Water Sampling Port	At Start and End of Flow	H_2O	Spigot: Grab and Bottles							X	X					X	X	X	X
Water Storage Tank	Water Sampling Port	At Start and End of Flow	H_2O	Spigot: Grab and Bottles				X	X	X							X	X	X	X
Vent Stack	Vent Stack Sampling Port	At Start and End of Flow	Gas	Summa	X	X														

Notes:
N_2 = Oxygen-depleted air
H_2O = Water
TPPH = Total purgeable petroleum hydrocarbons, analyzed using USEPA Method 8015M
TEPH = Total extractable petroleum hydrocarbons, analyzed using USEPA Method 8015M
LEL = Lower Explosive Limit

Procedures used for the collection and handling of gas and water samples collected during the compression test are summarized below in Table P-3.

TABLE P-3: SAMPLE COLLECTION AND HANDLING PROCEDURES

Sample Type	Sample Procedures	Purging	Sample Container	Handling Procedures	Documentation
Air Grab Sample	Connect re-used Teflon Tube with Swage Lock Fitting	Purge for 3 minutes, monitor O_2 and HC content continuously, collect sample	1 liter Tedlar Bag	Purge bag and tube after sampling, store for re-use.	Field Analysis Form
Gas Grab Sample	Connect re-used Teflon Tube with Swage Lock Fitting				
Air or Gas Sample from I/W Manifold	Connect new Teflon tube with Swage Lock Fitting		1 liter Summa Canister	Chain of Custody Protocol	Sample collection log, COC, Lab Report
Compliance Gas Sample at Vent Stack	Connect new Teflon tube with Swage Lock Fitting		1 liter Summa Canister	Chain of Custody Protocol	Sample collection log, COC, Lab Report
Water Sample	Collect from spigot in clean glass beaker and decant into sample containers	Purge for 30 seconds, collect sample	Lab Supplied Bottles	Put samples on ice, Chain of Custody Protocol	Sample collection log, COC, Lab Report

Notes:
O2 = Oxygen
HC = Hydrocarbon vapor
COC = Chain of custody

P.3 MONITORING AND RECORDING OF INJECTION PRESSURES, INJECTION RATES AND ANNULAR PRESSURES

As described in Attachment K and summarized in Table P-4, the injection and withdrawal stream temperature, pressure, flow rates and volumes, and the annular fluid pressure and temperature in the Injection/Withdrawal Well will be monitored continuously and recorded every 30 seconds by a central data acquisition and control system. In addition, annular and wellhead temperature and pressure will be monitored at the Piacentine 1-27 monitoring well and recorded every 30 seconds. The Piacentine 2-27 monitoring well is cemented to the surface and not perforated. It will be used only for conducting pulsed neutron logging to assess the growth of the air bubble in the subsurface and will not experience pressure increases inside the casing. Therefore, it will not be monitored for pressure or temperature.

Monitoring of wellhead and annular temperature and pressure at the Injection/Withdrawal Well and the Piacentine 1-27 well, and downhole monitoring of pressure and temperature in the Injection/Withdrawal Well, will be continued for approximately six to nine months after the completion of the approximately 90-day compression test as described further in Section P.4.

The annular fluids in these wells will be kept pressurized to near 100 psi by injecting a nitrogen blanket in the uppermost portion of the annulus. Note that annular pressures in the Injection/Withdrawal Well may change as a result of temperature changes during injection and withdrawal of hot air. Annular pressure-temperature changes will be evaluated to verify whether they are due to thermal effects or represent a well failure. The well annulus will be a closed system, monitored for pressure at the wellhead. As such, the nitrogen blanket on the annular fluid will behave according to Boyles Law and changes in pressure due to thermal effects can be estimated as follows:

$$\frac{P1 \times V1}{T1} = \frac{P2 \times V2}{T2}$$

Where P is pressure measured in psi(atmospheric), or psia, and T is measured in degrees Rankin

For example, with 4,500' of fluid in the annulus and 100' of nitrogen blanket, a temperature increase of 40 degrees Fahrenheit in the entire system would increase an initial wellhead pressure of 100 psia to 136 psia. This is caused by two changes in the system: the increased temperature increases the volume of the fluid slightly, and the volume of the nitrogen blanket is compressed in addition to responding to direct temperature effects. A smaller nitrogen blanket would experience a proportionately larger pressure increase.

Normal fluctuations in pressure, both up and down, are expected to occur to the annulus pressure during injection and withdrawal operations due to changes in the temperature. The normal range of these fluctuations can be estimated based on the information available at the time that the annulus is filled with fluid. A leak, however, changes the relatively fixed volume of fluid in the annulus and as a result the wellhead pressures will trend down over time. While still fluctuating somewhat due to thermal effects, in the event of a leak, pressures would never return to the previous equilibrium pressure. It is the long term trend, not the short term pressure fluctuations that would indicate an issue with the integrity of the casing, tubing, or possibly a leaking tubing packer. Therefore, annular pressure measurements will be evaluated for trends that indicate a loss of fluid volume. If such a trend is identified, it would be reported to EPA within 24 hours and further investigation would be required to determine the exact cause of the annular pressure decrease.

If necessary, the annular pressure will be maintained by pumping additional pressurized nitrogen into the headspace above the annular fluid, or by bleeding off nitrogen. Such adjustments and the resulting pressure changes will be recorded. A substantial pressure loss that is unrelated to thermal effects will be assumed to be related to a leak in the well, tubing or annulus. "Normal" pressure fluctuations are expected to occur due to changes in the thermal conditions of the annulus. The magnitude of those changes will depend on the relative volumes of the fluid and nitrogen blanket in the annulus. The range of pressure fluctuations due to changing temperature conditions during operations will be recorded during the injection/withdrawal test period. Keeping in mind that the nitrogen volume will be very small

compared to the annular fluid, the effect on the annulus pressure from a change in the fluid volume will be magnified considerably. For this reason a reduction by 30% of the previously recorded low pressure during operations would be considered "substantial" and require further investigation.

TABLE P-4: PRESSURE, TEMPERATURE AND FLOW SENSOR INSTRUMENTATION SPECIFICATIONS

Location	Equipment	Instrument Type	Model	Precision	Accuracy	Features/Remarks
I/W Well Wellhead	Wellhead PT Sensors	Piezoresistive Pressure Transducer	SPIDR	0.01% full scale	0.01 psi	Pressure measured by connecting oil filled steel capillary tubing; Temp via external sensor.
		Platinum Wire RTD		<0.01°F	± 001°F	
Piacentine 1-27 Well Wellhead	Wellhead PT Sensors	Piezoresistive Pressure Transducer	SPIDR	0.01% full scale	0.01 psi	Pressure measured by connecting oil filled steel capillary tubing; Temp via external sensor. Will be connected to a wireless transmitter at the wellhead.
		Platinum Wire RTD		<0.01°F	± 001°F	
Injection Pipe near I/W Well Manifold and Flow Pipe near Test Separator	PT/Flow Meter	Differential Pressure Flow Meter	ABB Totalflow Division X-series		Pressure: 0.05% of User Calibrated Spans from 20% to 100% of URL	Integral multi-variable transducer to measure differential pressure, static pressure and temperature. Module calculates flow and can store and/or transmit data. Internal battery that can be solar charged for unattended operation. Automation, control, alarming and data logging capability. Up to 180+ days of hourly /daily data records.
					Temperature:± 0.35°F over operating range from factory; ± 0.2°F repeatability over operating range after single point field calibration	

Notes:
Instrument model, precision and accuracy shall be as specified or equivalent
I/W = Injection/Withdrawal
psi = pounds per square inch
°F = degrees Farenheit
RTD = Resistance Temperature Detector
LCD = Liquid Crystal Display

P.4 MECHANICAL INTEGRITY TESTING

Prior to using the proposed Injection/Withdrawal Well for air injection, a mechanical integrity test will be performed, consisting of a Radial Cement Bond Log to be run after well completion, and a pressure test of the annular fluids between the injection tubing and the long string casing up to 2,500 pounds per

square inch (psi), as described in Attachment L-1. The pressure test will be performed by pressurizing the annular fluids and holding the pressure for 30 minutes. Pressures during the test will be recorded using the annular pressure-temperature sensors and tubing head pressure gauges. A chart recorder will be used to record the pressure response. The pressure change should not exceed five percent during the 30-minute test. EPA will be notified to witness the test. In addition, the mechanical integrity of the Piacentine 1-27 monitoring well will be validated prior to the compression test by conducting a pressure test of the annular fluids and tubing pressure in that well up to 2,500 psi, in similar fashion to the Injection/Withdrawal Well. As with the Injection/Withdrawal well, the pressure change should not exceed five percent during the test. EPA may require additional mechanical integrity tests prior to allowing injection, depending on the results of the formation Step Rate Test and core testing results (Attachment I).

The integrity of the injection process will be further validated using a thermal decay log and a spinner log of the Injection/Withdrawal Well. This test is proposed to be delayed slightly beyond 60 days so as not to interrupt the relatively brief 90-day compression testing schedule. Since use of the well will be limited to the short term compression test, delaying the test for approximately 30 days will not increase the risk of well failure. Because the medium being injected is air, a tracer test is not proposed to be conducted. EPA will be provided with a work plan detailing the approach to this test at least 30 days prior to implementation.

A failure of any mechanical integrity test will be reported to EPA within 24 hours as required under 40 CFR 144.51(k)(6).

The Injection/Withdrawal Well will be used to perform injection and flow testing for a period of approximately 90 days, after which the Injection/Withdrawal Well and the Piacentine 1-27 and 2-27 monitoring wells will be shut in, and the post-test monitoring period will be initiated. The post-test monitoring period will continue for a period of 6-9 months, unless EPA determines that a longer monitoring period is required based on the final measurements at the end of the post-test monitoring period.

During the compression test, a downhole packer and tubing assembly will be installed in the Piacentine 1-27 well. The packer will be installed such that the annulus between the tubing and casing will be isolated and will only be subject to higher pressures if there is a leak in the packer or within the tubing string. The wellhead pressures (tubing and annulus) will be monitored on a daily basis, both during the compression test and the post-test monitoring period until the well is abandoned or operation/responsibility for the well is returned to the original owner. Any leakage between the tubing and casing, or through the packer, will be detectable by changes in the annulus pressures measured at the wellhead. Corrective action will be taken to determine the source of the leakage and to remediate the problem. The wellhead pressures will be included in the monthly report provided to EPA. Mechanical Integrity Testing will not be performed on the well during this time.

In addition, wellhead pressures at Citizen Green 1 will be monitored during the compression test. Static bottomhole pressure will be measured in the Citizen Green 1 only before the compression test. During

the post-test monitoring period, only wellhead pressures will be monitored at this well (Citizen Green 1 will be returned to active status and therefore bottomhole pressure measurements will be difficult to obtain). As with Piacentine 1-27, this data will be recorded daily and will be included in the monthly report provided to EPA.

If at the end of the post-test monitoring period the bottomhole pressures in the Injection/Withdrawal Well are below the normal hydrostatic gradient, the Injection/Withdrawal Well will be maintained in an inactive status with monitoring and mechanical integrity testing performed every two years at a minimum in order to maintain the well in that status. If the bottomhole pressures in the Injection/Withdrawal well exceed the normal hydrostatic gradient at the end of the post-test monitoring period, the well will be plugged and abandoned in accordance with EPA requirements as described in Attachment Q. Under this circumstance, the well would not be subject to further monitoring or mechanical integrity testing.

Ownership of the Piacentine 1-27 and 2-27 monitoring wells will be turned over to the field operator after the conclusion of the post-test monitoring period. PG&E will work with the field operator to meet any EPA requirements regarding these wells after the transfer of ownership. It is assumed that if the bottomhole pressures in these wells falls below the normal hydrostatic gradient after transfer of ownership, the wells would revert back to DOGGR jurisdiction, as they are currently.

P.5 MONITORING AND REPORTING

Prior to the start of the test, bottomhole pressure measurements will be obtained from the Piacentine 1-27 well and the Citizen Green 1 well.

The following parameters will be recorded daily and reported to EPA in monthly reports until the compression test is completed:

- Injection pressure, temperature flow rate, oxygen content, and total injected volume;
- Withdrawal pressure, temperature, flow rate, combustible gas content, and total withdrawn volume;
- Shut-in pressure and temperature for the Injection/Withdrawal Well and Piacentine 1-27; and
- Wellhead tubing and annular pressure in the Injection/Withdrawal Well, Piacentine 1-27 and Citizen Green 1.

In addition, the following information will be provided:

- Injection air chemical analysis results (for fixed gases);
- Withdrawal air chemical analysis results, as applicable (for fixed gases, combustible hydrocarbons and volatile organic compounds);
- Produced water chemical analysis results and disposal documentation, as applicable;

- Monitoring wellhead pressure and temperature readings;
- Downhole temperature and pressure readings, when recorded;
- The results of Mechanical Integrity Tests;
- The results of Falloff Tests;
- The results of Step Rate Tests;
- Any shut down events; and
- Any well maintenance or work-over activities.

Because it is not practicable, monitoring of downhole pressures in Citizen Green 1 will not be performed once the well has been returned to gas production after completion of the compression test.

The reports will include an assessment comparing the measured results to design performance parameters and expected reservoir behavior.

P.6 RECORD KEEPING

Complete records from the above monitoring will be maintained by PG&E for the Injection/Withdrawal Well and compression test until at least 5 years after plugging and abandonment of the Injection/Withdrawal Well. In addition, calibration and maintenance records will be maintained for all equipment. These records will only be discarded after written notification to, and approval from, EPA.

ATTACHMENT Q

Plugging and Abandonment Plan

CONTENTS

Section Q-1 Requirements

Section Q-2 Injection/Withdrawal Well Plugging and Abandonment Plan

Section Q-3 Monitoring Well Plugging and Abandonment Plan

Attachment Q-1 Plugging and Abandonment Plans for Injection/Withdrawal Well

Attachment Q-2 Plugging and Abandonment Cost Estimate for Injection/Withdrawal Well

Attachment Q-3 Plugging and Abandonment Schematic Drawing for Injection/Withdrawal Well

Attachment Q-4 EPA Form 7520-14 for Injection/Withdrawal Well

Attachment Q-5 Plugging and Abandonment Plans for Monitoring Wells

Attachment Q-6 Plugging and Abandonment Cost Estimates for Monitoring Wells

Attachment Q-7 Plugging and Abandonment Schematic Drawings for Monitoring Wells

Q.1 REQUIREMENTS

Submit a plan for plugging and abandonment of the well I/W well and monitoring wells.

Q.2 APPROACH

The Injection/Withdrawal Well will be used to perform injection and flow testing for a period of approximately 90 days, after which the Injection/Withdrawal Well and the Piacentine 1-27 and 2-27 monitoring wells will be shut in and post-test pressure monitoring will be performed for a period of six to nine months using the existing wellhead and down-hole sensors. Computer modeling indicates that pressures will dissipate in the reservoir as water flows into the underlying aquifers. At the end of the monitoring period, if reservoir pressures have fallen below the normal hydrostatic gradient, the Injection/Withdrawal Well will be maintained in an inactive status until such time that the field operator either obtains a new permit or the well is plugged and abandoned. Annual Mechanical Integrity Testing would not be performed under this circumstance. The monitoring wells are being leased from the gas field operator for the duration of the compression test and post-test monitoring, and ownership of the monitoring wells would be transferred back to the operator if pressures fall below the normal hydrostatic gradient.

Conversely, if pressures remain above the normal hydrostatic gradient, the Injection/Withdrawal Well will be plugged and abandoned in accordance with EPA requirements as described in this attachment. However, because PG&E does not own the monitoring wells, PG&E would work with the current field operator to ensure compliance with the EPA permit requirements.

Q.2 INJECTION/WITHDRAWAL WELL PLUGGING AND ABANDONMENT PLAN

The proposed plugging and abandonment plan for the Injection/Withdrawal Well is provided in Attachment Q-1. A cost estimate is provided in Attachment Q-2, and the plugging and abandonment schematic is provided in Attachment Q-3. This information is also contained in EPA Form 7520-14, which is included as Attachment Q-4.

Prior to the plugging and abandonment of the injection well, a revised plugging and abandonment plan may be submitted to EPA for review and approval, based on the actual well construction, well conditions, and depth to USDW.

Q.3 MONITORING WELL PLUGGING AND ABANDONMENT PLAN

The plugging and abandonment plans for monitoring wells Piacentine 1-27 and 2-27 are provided in Attachment Q-5. Cost estimates are provided in Attachment Q-6, and plugging and abandonment schematics are provided in Attachment Q-7. As described in Attachments Q5 and Q7, a 200 foot cement plug will be placed across the surface casing shoe in both monitoring wells. The EPA has requested the placement of at least 200 feet of cement across the base of USDWs in the annulus in addition to the

interior plug at this depth in the Piacentine 1-27, and if possible, to circulate cement in the annulus to the surface.

Circulating cement to the surface from 100 feet below the USDW may prove difficult. As a contingency option, Attachment Q-7 presents three different scenarios for cementing the casing to the surface. Under the first scenario, the casing will be perforated from 4,170 to 4,171 feet and cemented to the surface. If the field conditions prevent this from happening, the second scenario will apply where the casing will be perforated approximately 100 feet below the surface casing and cement will be squeezed to the surface. Finally, if cement cannot be squeezed to the surface at this depth, the third scenario will include perforating the casing approximately 100-150 feet below the base of freshwater and squeezing cement to the surface.

As noted above, the monitoring wells are owned by the field operator; therefore, completed EPA Forms 7520-14 are not included for the monitoring wells at this time.

ATTACHMENT Q-1

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PG&E

King Island I/W Test Well No. 1

Location: X=1734880.641 Y= 577346.753 (NAD 27, Zone III)
Section 27, T 3N, R 5E, San Joaquin County, California.
Elevation: -6.5' ground. +5.5' KB (NGVD 29)

Take all measurements from KB which is 12' above ground.
Check operation of BOE day.
Keep hole full at all times.

Present Condition
TD:~4772' MD PD: ~4767' MD
Casing: 13-3/8", 54.5#, J-55 surface casing cemented at 600
9-5/8", 40#, J-55 & N-80 intermediate casing cemented at 4730'.
5-1/2" premium wire wrap liner gravel packed from 4710' to 4772'.
Tubing: 5-1/2", 15.5#, J-55, LT&C, LT&C thread with seal assembly stabbed into SC packer at ~4637'.

Note: A downhole permanent pressure gauge is above the seal assembly. There is ¼" cable that runs outside of tubing and it is affixed to the tubing with 5-1/2" Cross Coupling Cable Protectors at every connection. The cable goes through the outlets in the tubing hanger and tubing head top flange and is connected to an instrument junction box at surface.
Note: There is 4% KCl water with corrosion inhibitor and biocide in the annulus. This is a directional well with maximum angle of 20 degrees.

Note: Base of Fresh Water is ~150' (per DOG)

Note: Base of USDW is estimated at 4100' MD (Will determine more accurate depth after logging)

Abandonment Program

1. **Move in Workover rig. Kill tubing with 10 ppg mud. Disconnect ¼" cable form the instrument junction box. Remove the cable fittings. Cut ¼" cable. Remove X-mas tree. Install BOE and test to 3000 psig. Notify EPA and if EPA requires notify DOG to witness the BOE test. Remove the cable fittings above the tubing hanger.**

2. **Pull up tubing. Cut the cable below the tubing hanger. Pull seal assembly out of SC packer at 4637'MD. Circulate and change hole to 10 ppg mud. Pull out 5-1/2" tubing while cutting the ¼" cable from the outside of the tubing. Lay down tubing. Pick up 2-3/8", 4.7#, J-55, EUE work string tubing.**

3. **Run open-ended tubing to PD at 4767' MD. Reverse hole clean with 10 ppg mud.**

4. **Zone Plug: Equalize 150 sacks Class G cement premixed 2% CaCl2 (over 300 lineal feet) at 4767' MD. Wait on cement for 4 hours. Locate top of cement plug which**

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must be above 4500’ MD. Notify EPA to witness the cementing operation.

5. **<u>USDW Plug</u>: Equalize 150 sacks Class G cement premixed 2% CaCl2 (over 400 lineal feet) at 4200’ MD (USDW depth will be determined for logs and plug depth might be modified). Wait on cement for 4 hours. Locate top of cement plug which must be above 4000’ MD. Notify EPA to witness the cementing operation.**

6. **<u>Shoe Plug:</u> Equalize 110 sacks Class G cement premixed 3% CaCl2 (300 lineal feet) at 700'. Wait on cement for 4 hours. Locate top of cement plug which must be above 500'. Notify EPA to witness the cementing operation.**

7. **<u>Base of Fresh Water Plug</u>: Equalize 120 sacks of Class G cement premixed 3% CaCl2 (over 300 lineal feet) at 100’ below base of fresh (base of fresh water will be determined from the logs, should be around 150’). Wait on cement for 4 hours. Top of cement plug should be at surface. Notify EPA to witness the cementing operation.**

8. **Cut 9-5/8” and 13-3/8” casing 5’ below ground. Weld steel plate on stub. Abandon well.**

March 19, 2014

ATTACHMENT Q-2

COST ESTIMATE & AUTHORITY FOR EXPENDITURE

DATE: March 19, 2014

OPERATOR: PG&E

LEASE & WELL NO. King Island I/W Test Well No. 1

LOCATION: Section 27, T 3N, R 5E, MDB&M

COUNTY: San Joaquin STATE: California PROJECTED TD: 4772' MD

PORPOSE: Abandon well per abandonment program dated March 17, 2014

Classification: Class 5 injection well

THIS IS AN ESTIMATE ONLY AND THERE IS NO GUARANTEE, EITHER EXPRESS OR IMPLIED, THATTHE ACTUAL COSTS WILL BE EQUAL TO, LESS OR GREATER THAN THOSE ESTIMATED.

	Abandonment	REMARKS
TANGIBLE LEASE & WELL EQUIP.		
1. Surface Csg. & Cond.		
2. Inter. Csg. & Lnr.		
3. Production Csg. & Lnr.		
4. Tubing		
5. Wellhead		
6. Flow Line		
7. Process & Storage Equip.		
8. Packers, Anchors, Misc.		
Total Lease & Well Equip.	**$0**	
Intangibles		
1. a. Footage ft. @ $		
b. Mobilization, Service Charges	$7,000	
c. Daywork 5 Days @ $8,000 per day	$40,000	
d. Service Rig		
e. Water	$2,000	
f. Mud & Chemicals	$5,000	
g. Mud Conditioning		
2. a. Operator's Overhead		
b. Engineering Supervision	$12,000	
c. Mud Log		
d. Bridge Plug, Cement Retainer		
e. Drill Stem Test		
f. Permits/Survey/Insurance/Title work		
g. DOG Bond		
3. a. Cement & Service	$75,000	
b. Floating Equipment		
c. Welding, Cutting Casing	$1,000	
d. Slickline, Pulling Capillary Tubing		
4. Perforating/Chemical Cut/Logging		
5. a. Locations Restoration		
b. Transp. & Freight	$6,000	
c. Roustabout Labor	$1,000	
d. Lodging & Meals		
6. a. Bits		
b. Rental Tools	$15,000	
c. Repairs		
d. Contingencies	$24,000	
Total Intangibles	**$188,000**	
Total	**$188,000**	

$188,000 to Abandon well

IRANI ENGINEERING

Submitted to:

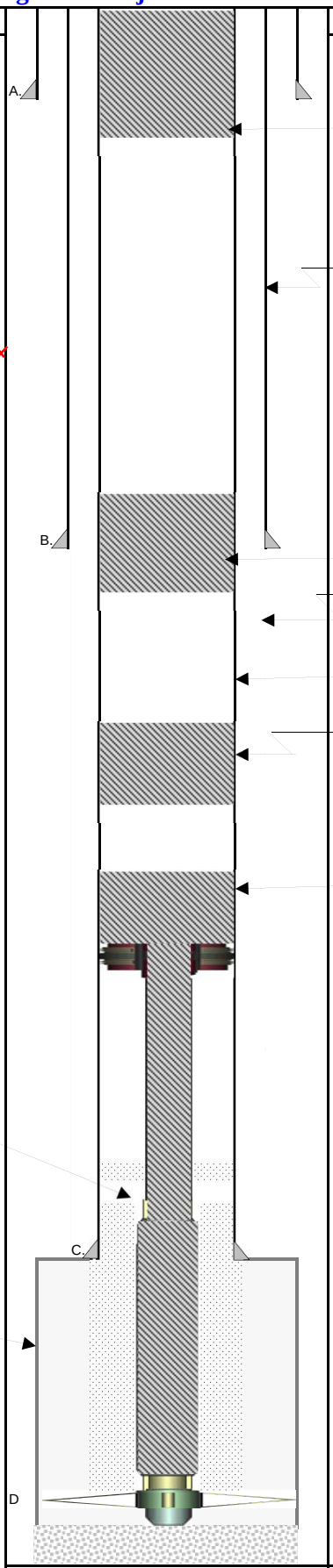
Approval Date

ATTACHMENT Q-3 - Proposed Abandonment Schematic

King Island Injection-Withdrawal Test Well No. 1

COMMENTS

EQUIPMENT DESCRIPTION



20" Casing @ 60' cemented to surface

Cement plug from surface - 250'

13-3/8#, 54.5#, J-55 ST&C

13-3/8" Casing @ 600' cemented to Surface

Cement plug from 500'-700'

12-1/4" Hole

9-5/8", 40#, J&N production casing

Cement plug from 4000' - 4200'

Cement plug from 4500' - 4767'

2. Baker SC-1 Packer Top @ 4637'
3. Upper Extension
4. Sliding Sleeve
5. Seal Bore
6. Lower Extension
7 Blank 5-1/2", 17#, N-80

9-5/8" Casing @ 4,730' MD =4681' VD Cemented to surface

8 5-1/2" premium wire wrap screen (6" OD)

9 O-ring seal sub

10 Circ Shoe & Centralizer

11 Total depth at 4772'MD = 4721' VD

PBTD: 4772' MD 4721' TVD

TD: 4772' MD 4721' TVD

PG&E
WELL COMPLETION DIAGRAM

FIELD	NA		
WELL #	King Island I-W Test Well No. 1		
Ground MSL -6'			
KB	6'		
LOCATION	Sec. 27, T 3N, R 5E, MDB&M		

DIRECTIONAL DATA

MAX ANGLE	20	THRU ZONE	4772'
KOP	3465'	HOLE TYPE	Directional
BH Location	Vertical	255' N & 215' E	

SURFACE EQUIPMENT

TREE	3" 3M
SWAB CAP SIZE & THRD	8rd EUE lift thread
TOP TREE FLANGE	5" 3M
TUBING SPOOL FLANGE	11" 3M

TUBING DETAIL

	1st or LS	SS or Btm of Taper
SIZE	5-1/2"	
WEIGHT	15.5#	
GRADE	J-55	
DEPTH	4637'	
THREAD	LT&C	
NEW/USED	NEW	
COATING	None	
SCSSV	None	
Min. I.D.	4.825"	

	O. D. (in.)	I. D. (in.)	LENGTH (ft)	DESCRIPTION
1.	5-1/2"	4.825"	4637'	5-1/2", 15.5#, J-55
2.	8"	5"	5'	Baker SC-1 Packer
3.	5.5"	4.892	6'	Upper Extension
4.	5.81"	4.892	2'	Baker Model S Sliding Sleeve
5.	5.56"	4.892	1'	Baker Seal Bore
6.	5.56"	4.892'	17'	Lower Extension
7.	5.5"	4.892	38.00	Blank 5-1/2", 17#, N-80
8.	6"	4.892	62'	51/2" Wire wraped screen
9.	5.5"	1.813"	2.71	O-ring seal sub
10.	5.5"	N/A	1.80	shoe
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				

CASING DETAIL

#	SIZE	WGHT	GRADE	THRD	DEPTH
A	20"	53#	NA		0' - 60'
B	13-3/8"	54.5	J-55	LT&C	0' - 600'
C	9-5/8""	40#	J&N	LT&C	0' - 4,702'
D	5-1/2"	17#	N-80	LT&C	4637'-4772'
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					

Prepared By:	Saeed Irani	Date	January 2, 2014
Updated By:	Saeed Irani	Date	January 2, 2014
		Printed on	April 16, 2014

Completed:

File: J:\Project Active\WorleyParsons PGE CAES\Task 3.7.4_3.7.7 & 3.7.8 UIC Permit\Permit Application\Final Permit Application Changes\Attachment Q\P&A Programs\Attachment Q3\[King Island Test Well No 1 WBD abandonment.xls]Actual WBD

ATTACHMENT Q-4

OMB No. 2040-0042 Approval Expires 11/30/2014

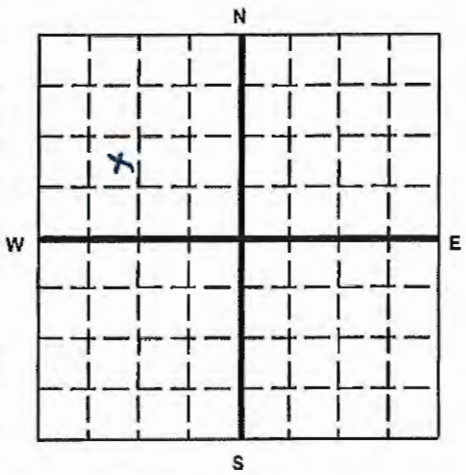
EPA

United States Environmental Protection Agency
Washington, DC 20460

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility	Name and Address of Owner/Operator
PG&E Cases Project Test Injection/Withdrawal Well King Island, San Joaquin County, California	Pacific Gas and Electric Company 77 Beale Street, San Francisco, CA 94105

Locate Well and Outline Unit on Section Plat - 640 Acres



State	County	Permit Number
California	San Joaquin	

Surface Location Description

SE 1/4 of NE 1/4 of SW 1/4 of NW 1/4 of Section 27 Township 3N Range 5E

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location 1697 ft. frm (N/S) N Line of quarter section
and 1058 ft. from (E/W) W Line of quarter section.

TYPE OF AUTHORIZATION
- [x] Individual Permit
- [ ] Area Permit
- [ ] Rule

Number of Wells ____

Lease Name

WELL ACTIVITY
- [ ] CLASS I
- [x] CLASS V
- [ ] CLASS II
  - [ ] Brine Disposal
  - [ ] Enhanced Recovery
  - [ ] Hydrocarbon Storage
- [ ] CLASS III

Well Number

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
5-1/2"	17#	40'	40'	17"
5-1/2"	17#	95'	95'	9-5/8"CS
9-5/8"	40#	4730'	4725'	12-1/4"
13-3/8	54.5#	600'	595'	17-1/2"

METHOD OF EMPLACEMENT OF CEMENT PLUGS
- [ ] The Balance Method
- [ ] The Dump Bailer Method
- [ ] The Two-Plug Method
- [ ] Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	5-1/2"	9-5/8"	9-5/8"	9-5/8"			
Depth to Bottom of Tubing or Drill Pipe (ft	4767'	4200'	700'	250'			
Sacks of Cement To Be Used (each plug)	150	150	110	110			
Slurry Volume To Be Pumped (cu. ft.)	172	172	128	128			
Calculated Top of Plug (ft.)	4254'	3795'	400'	surface			
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.8	15.8	15.8	15.8			
Type Cement or Other Material (Class III)	G	G	G	G			

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
Gravel Pack, Open hole 4730'	4772'		

Estimated Cost to Plug Wells

$188,000

Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title *(Please type or print)*	Signature	Date Signed
Mike Medeiros, Manager, Renewable Energy Dev.		5-16-14

EPA Form 7520-14 (Rev. 12-11)

ATTACHMENT Q-5

IRANI ENGINEERING, INC.
PETROLEUM ENGINEER
2625 FAIR OAKS BOULEVARD, SUITE 10
SACRAMENTO, CALIFORNIA 95864
916-482-2847
FAX 916-482-7514

Princeton Natural Gas, LLC
Piacentine No. 1-27

Location: X=1734950 Y= 577480 (NAD 27, Zone III)
Section 27, T 3N, R 5E, San Joaquin County, California.
Elevation: -6.5' ground. +6.5' KB (NGVD 29)

Take all measurements from KB which is 13' above ground.
Keep hole full at all times.
Check operation of BOE daily

Present Condition (Abandoned)
TD 4900' MD PD: 4830'
Casing: 8-5/8", 24#, J-55, cemented to surface @ 627'.
5-1/2", 15.5#, K-55, cemented at 4900'. Top of cement in the annulus is at 4175'.
Tubing: 2-3/8", 4.7#, J-55, EUE tubing hung at ~4650'
Perforations: 4670'-4682', 4684'-4690', 4700'-4710', 4720'-4724', 4750'-4764'. Open.
Base of freshwater: ~150' (per Division of Oil & Gas).
Base of USDW: 4007'
Abandonment program

1. **Move in workover rig. Kill well 10 ppg mud. Install BOE and test. Notify EPA to witness, and if EPA requires, notify DOG to witness. Pressure test BOE to 2500 psig for 1 hour. Use recorded chart for BOE test.**

2. **Lower tubing to 4830'. Equalize 50 sacks of Class G cement premixed 2%CaCl2 at 4830' (over 400 lineal feet). Wait on cement for 4 hours. Locate top of cement plug which must be above 4570'. Notify EPA to witness and if EPA requires, Notify DOG to witness. Pull up tubing to 3700'.**

3. **Run wireline guns and shoot 4 JHPF from 4170'-4171'. Open up the valve Between 8-5/8" casing and 5-1/2" casing. Close BOE bag. Pump freshwater Into tubing and try to establish circulation between 5-1/2" casing and 5-1/2" X 8-5/8" annulus. If not successful go to Step No. 4 otherwise follow the following procedure and then go to Step 7.**

   Pull out tubing. Rig up cementing truck. Pump in 785 sacks* of Class G cement premixed 8% Gel and 0.75% CFR3 into 5-1/2" casing until cement is Circulated out of 5-1/2" X 8-5/8" annulus. Make sure the 5-1/2" casing if full of cement.

   ***The cement volume is calculated based on annular volume between 5-1/2" and 7-7/8" hole and 8-5/8" casing plus 25% from 4171'to surface plus**

volume of 5-1/2" casing from surface to 4171'. The yield for cement is 1.89 CF/Sack

4. **Rig up cementing truck and connect to tubing. Keep 2-3/8" X 5-1/2" annulus closed. Pump 106 sacks of Class G cement premixed 0.75 CFR3* (1.16 Cf/sack yield) into 2-3/8" tubing. Displace cement with 16 bbls of mud (tubing is at 3700' at this time). Pull up tubing to 3500'. Reverse circulate tubing clean. Wait on cement for 6 hours. Locate top of cement plug which must be above 3907'. Notify EPA to witness and if EPA requires, Notify DOG to witness. Pull out tubing.**

   *** Cement volume is calculated based on volume of 400' lineal feet of cement in the 5-1/2" X 7-7/8" annulus plus volume of 400' lineal feet of cement in 5-1/2" casing.**

5. **Wireline shoot 4 JHPF from 727' to 728' (100' below surface casing shoe). Open up the valve between 5-1/2" X 8-5/8" annulus. Try and establish Circulation between 5-1/2" casing and 5-1/2" X 8-5/8" annulus. If successful, rig up cementing truck. Connect to 5-1/2" casing. Pump 140 sacks of Class G cement premixed 8% gel and 0.75% CFR3* into annulus. Stop pumping cement if cement reaches surface from 5-1/2" X 8-5/8" annulus otherwise pump all the cement into 5-1/2" casing, make sure 5-1/2" casing is full of cement the go Step No. 7.**

   If not successful establishing circulation between 5-1/2" casing and 5-1/2" X 8-5/8" annulus then pump in 80 sacks of Class G cement premixed 3% CaCl2 and 0.75% CFR3 into 5-1/2" casing. Displace cement with 10 bbls of mud. Wait on cement for 4 hours. Locate top of cement plug which must be above 527'. Notify EPA to witness and if EPA requires, Notify DOG to witness. Got to Step No. 6.**

   ***The cement volume is calculated based on annular volume between 5-1/2" and 7-7/8" hole and 8-5/8" casing plus 10% excess from 728'to surface plus volume of 5-1/2" casing from surface to 728'. The yield for cement is 1.89 CF/Sack**

   **** Cement volume is calculated based on volume of 300' lineal feet of annular volume plus volume of 300' lineal feet of cement in 5-1/2" casing. The yield for cement is 1.16 CF/Sack.**

6. **Wireline shoot 4 JHPF at 300'. Establish circulation between 5-1/2" casing and 5-1/2" X 8-5/8" annulus. Rig up cementing truck. Pump 57 sacks of Class G cement premixed 8% gel, 3% CaCl2. and 0.75% CFR3* into annulus. Stop pumping cement if cement reaches surface from 5-1/2" X 8-5/8" annulus. Make sure the 5-1/2" casing is full of cement.**

   ***The cement volume is calculated based on annular volume between 5-1/2" and 8-5/8" casing plus 10% excess from 300'to surface plus volume of 5-1/2" casing from surface to 300'. The yield for cement is 1.89 CF/Sack**

7. **Cut 8-5/8" and 5-1/2" casing 5' below ground. Weld steel plate on stub. Abandon well.**

April 5, 2014

ATTACHMENT Q-5

IRANI ENGINEERING
PETROLEUM ENGINEER
2625 FAIR OAKS BLVD., SUITE 10
SACRAMENTO, CALIFORNIA 95864
916-482-2877
FAX 916-482-7514

PG&E

Piacentine No. 2-27

Location: X= 1734574, Y 577271 (NAD 27, Zone III)
Section 27, T 3N, R 5E, MDB&M, San Joaquin County., California.
Elevation: -4.5' ground. +7.5' KB (12' KB)(NGVD 29)
Lat: 38.08155572 Long: 121.422162329 (NAD 83)
API: 077-20736

Take all measurements from KB Which is 12' above ground.
Keep hole full at all times.
Check operation of BOE daily

Present Condition
TD: 4970' PD: ~4920'
Casing: 9-5/8", 36#, J-55 surface cemented at 614' to surface.
5-1/2", 15.5#, J-55, LT&C cemented at 4969' to surface.
Tubing: No Tubing
Perforations: No Perforations

Note: The base of fresh water is at 150' per Division of Oil & Gas
Note: The base of USDW is at 3998.5'
Note: There is fresh water in 5-1/2" casing.

Abandonment Program

1. **Move in workover rig. Pick up 4900' of 2-3/8", 4.7#, J-55, EUE tubing.**

2. **Lower tubing to PD around 4900'. Change hole to 10 ppg mud. Pull up to 4100'.**

3. **USDW Plug: Equalize 50 sacks of Class G cement premixed 2% CaCl2 at 4100' (over 400 lineal feet). Wait on cement for 4 hours. Locate top of cement plug which must be above 3898'. Notify EPA to witness and if EPA requires, Notify DOG to witness. Pull up tubing to 300'.**

4. **Shoe Plug: Equalize 50 sacks of Class G cement premixed 3% CaCl2 at 714' (300 lineal feet). Wait on cement for 4 hours. Locate top of cement plug which must be above 514'. Notify EPA to witness and if EPA requires, Notify DOG to witness. Pull up tubing to 300'.**

5. **Surface Plug: Equalize 35 sacks of cement premixed 3% Cal2 (over 300 lineal feet) at 300' to surface. Notify EPA to witness and if EPA requires, Notify DOG to witness.**

6. **Cut 9-5/8" and 5-1/2" casing 5' below ground. Weld steel plate on stub. Abandon well.**

March 18, 2014

ATTACHMENT Q-6

COST ESTIMATE & AUTHORITY FOR EXPENDITURE

DATE: March 17, 2014

OPERATOR: PG&E

LEASE & WELL NO. Piacentine No. 1-27

LOCATION: Section 27, T 3N, R 5E, MDB&M

COUNTY: San Joaquin STATE: California PROJECTED TD: 4900'

PORPOSE: Abandon well per abandonment program dated March 16, 2014

Classification: Class 5 Observation well

THIS IS AN ESTIMATE ONLY AND THERE IS NO GUARANTEE, EITHER EXPRESS OR IMPLIED, THATTHE ACTUAL COSTS WILL BE EQUAL TO, LESS OR GREATER THAN THOSE ESTIMATED.

	Abandonment	REMARKS
TANGIBLE LEASE & WELL EQUIP.		
1. Surface Csg. & Cond.		
2. Inter. Csg. & Lnr.		
3. Production Csg. & Lnr.		
4. Tubing		
5. Wellhead		
6. Flow Line		
7. Process & Storage Equip.		
8. Packers, Anchors, Misc.		
Total Lease & Well Equip.	**$0**	
Intangibles		
1. a. Footage ft. @ $		
b. Mobilization, Service Charges	$7,000	
c. Daywork 4.5 Days @ $8,000 per day	$36,000	
d. Service Rig		
e. Water	$2,000	
f. Mud & Chemicals	$4,000	
g. Mud Conditioning		
2. a. Operator's Overhead		
b. Engineering Supervision	$10,000	
c. Mud Log		
d. Bridge Plug, Cement Retainer		
e. Drill Stem Test		
f. Permits/Survey/Insurance/Title work		
g. DOG Bond		
3. a. Cement & Service	$40,000	
b. Floating Equipment		
c. Welding, Cutting Casing	$1,000	
d. Slickline, Pulling Capillary Tubing		
4. Perforating/Chemical Cut/Logging	$10,000	
5. a. Locations Restoration		
b. Transp. & Freight	$4,000	
c. Roustabout Labor	$1,000	
d. Lodging & Meals		
6. a. Bits		
b. Rental Tools	$13,000	
c. Repairs		
d. Contingencies	$12,000	
Total Intangibles	**$140,000**	
Total	**$140,000**	

$140,000 to Abandon well

IRANI ENGINEERING

Submitted to:

Approval Date

ATTACHMENT Q-6

COST ESTIMATE & AUTHORITY FOR EXPENDITURE

DATE: March 18, 2014

OPERATOR: PG&E

LEASE & WELL NO. Piacentine No. 2-27

LOCATION: Section 27, T 3N, R 5E, MDB&M

COUNTY: San Joaquin STATE: California PROJECTED TD: 4970'

PORPOSE: Abandon well per abandonment program dated March 18, 2014

Classification: Class 5 Observation well

THIS IS AN ESTIMATE ONLY AND THERE IS NO GUARANTEE, EITHER EXPRESS OR IMPLIED, THATTHE ACTUAL COSTS WILL BE EQUAL TO, LESS OR GREATER THAN THOSE ESTIMATED.

	Abandonment	REMARKS
TANGIBLE LEASE & WELL EQUIP.		
1. Surface Csg. & Cond.		
2. Inter. Csg. & Lnr.		
3. Production Csg. & Lnr.		
4. Tubing		
5. Wellhead		
6. Flow Line		
7. Process & Storage Equip.		
8. Packers, Anchors, Misc.		
Total Lease & Well Equip.	**$0**	
Intangibles		
1. a. Footage ft. @ $		
b. Mobilization, Service Charges	$7,000	
c. Daywork 3 Days @ $8,000 per day	$24,000	
d. Service Rig		
e. Water	$1,000	
f. Mud & Chemicals	$4,000	
g. Mud Conditioning		
2. a. Operator's Overhead		
b. Engineering Supervision	$8,000	
c. Mud Log		
d. Bridge Plug, Cement Retainer		
e. Drill Stem Test		
f. Permits/Survey/Insurance/Title work		
g. DOG Bond		
3. a. Cement & Service	$15,000	
b. Floating Equipment		
c. Welding, Cutting Casing	$1,000	
d. Slickline, Pulling Capillary Tubing		
4. Perforating/Chemical Cut/Logging		
5. a. Locations Restoration		
b. Transp. & Freight	$4,000	
c. Roustabout Labor	$1,000	
d. Lodging & Meals		
6. a. Bits		
b. Rental Tools	$18,000	Including tubing rental
c. Repairs		
d. Contingencies	$12,000	
Total Intangibles	**$95,000**	
Total	**$95,000**	

$95,000 to Abandon well

IRANI ENGINEERING

Submitted to:

Approval Date

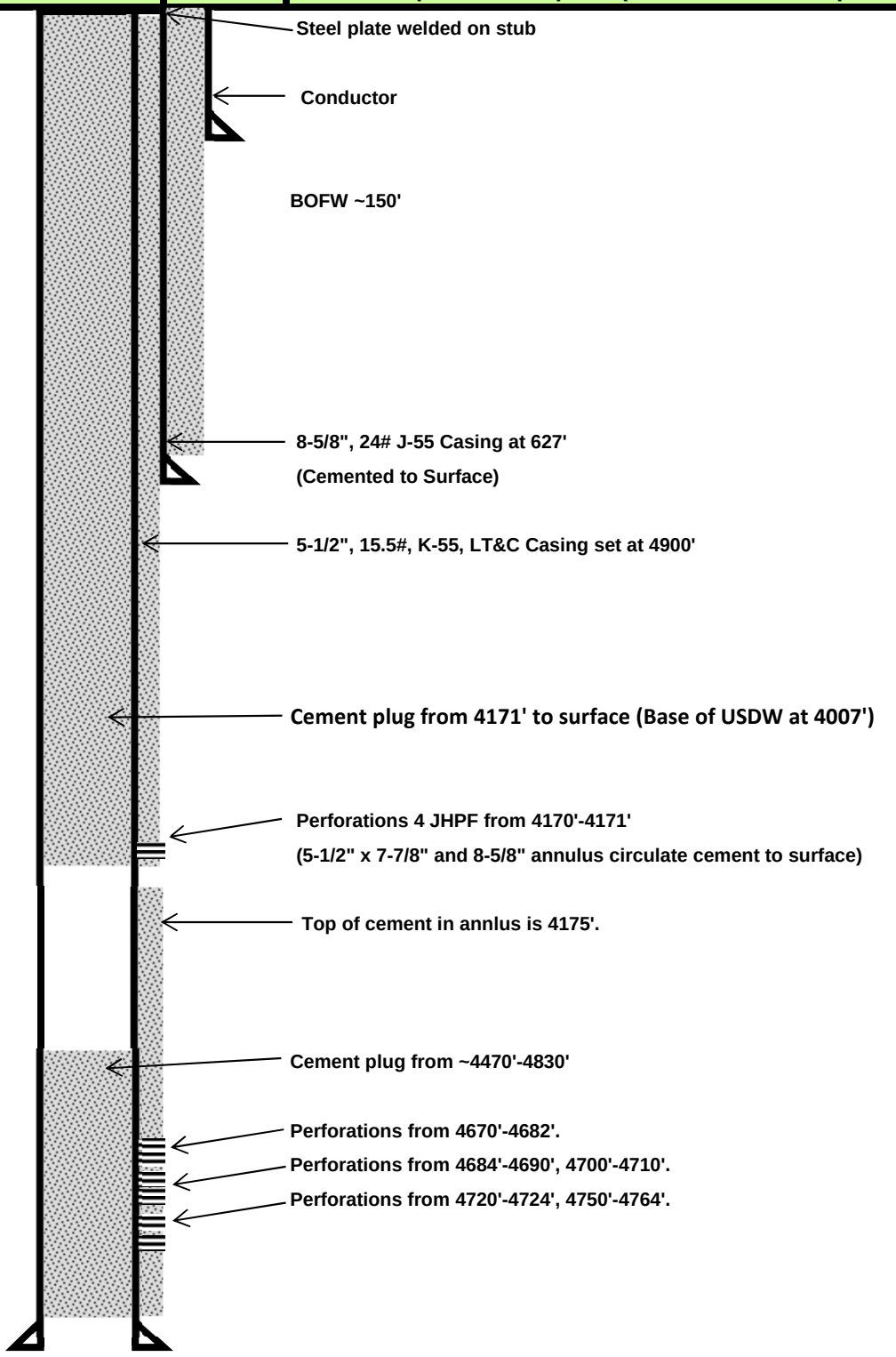
Attachment Q-7

PG&E

Piacentine 1-27 (API No. 077-20484) Abandonment WBD Scenario No. 1
San Joaquin, California
Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -6.5' ground, +6.5' KB. All the measurements are from KB which is 13' above ground.



Installation		Depth & Description (after Planned Completion)	OD	ID
		Steel plate welded on stub		
		Conductor		
		BOFW ~150'		
		8-5/8", 24# J-55 Casing at 627' (Cemented to Surface)	8-5/8"	8.097"
		5-1/2", 15.5#, K-55, LT&C Casing set at 4900'	5-1/2"	4.950"
		Cement plug from 4171' to surface (Base of USDW at 4007')		
		Perforations 4 JHPF from 4170'-4171' (5-1/2" x 7-7/8" and 8-5/8" annulus circulate cement to surface)		
		Top of cement in annlus is 4175'.		
		Cement plug from ~4470'-4830'		
		Perforations from 4670'-4682'.		
		Perforations from 4684'-4690', 4700'-4710'.		
		Perforations from 4720'-4724', 4750'-4764'.		
		PD=surface		
		TD=4900'		

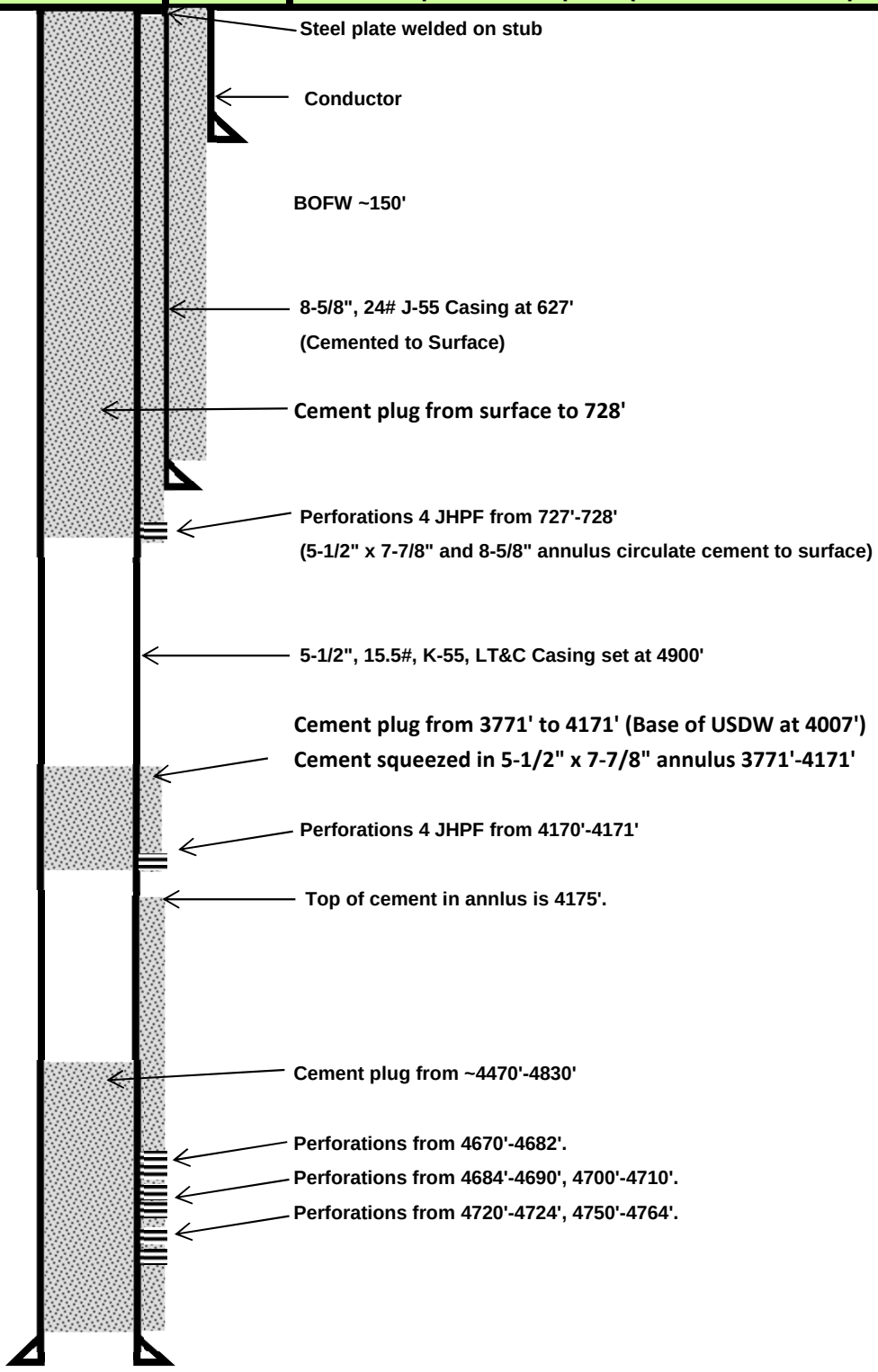
Attachment Q-7

PG&E

Piacentine 1-27 (API No. 077-20484) Abandonment WBD Scenario 2
San Joaquin, California
Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -6.5' ground, +6.5' KB. All the measurements are from KB which is 13' above ground.



Installation	Depth & Description (after Planned Completion)	OD	ID
	8-5/8", 24# J-55 Casing at 627' (Cemented to Surface)	8-5/8"	8.097"
	5-1/2", 15.5#, K-55, LT&C Casing set at 4900'	5-1/2"	4.950"

Prepared by Irani Engineering 4/5/2014

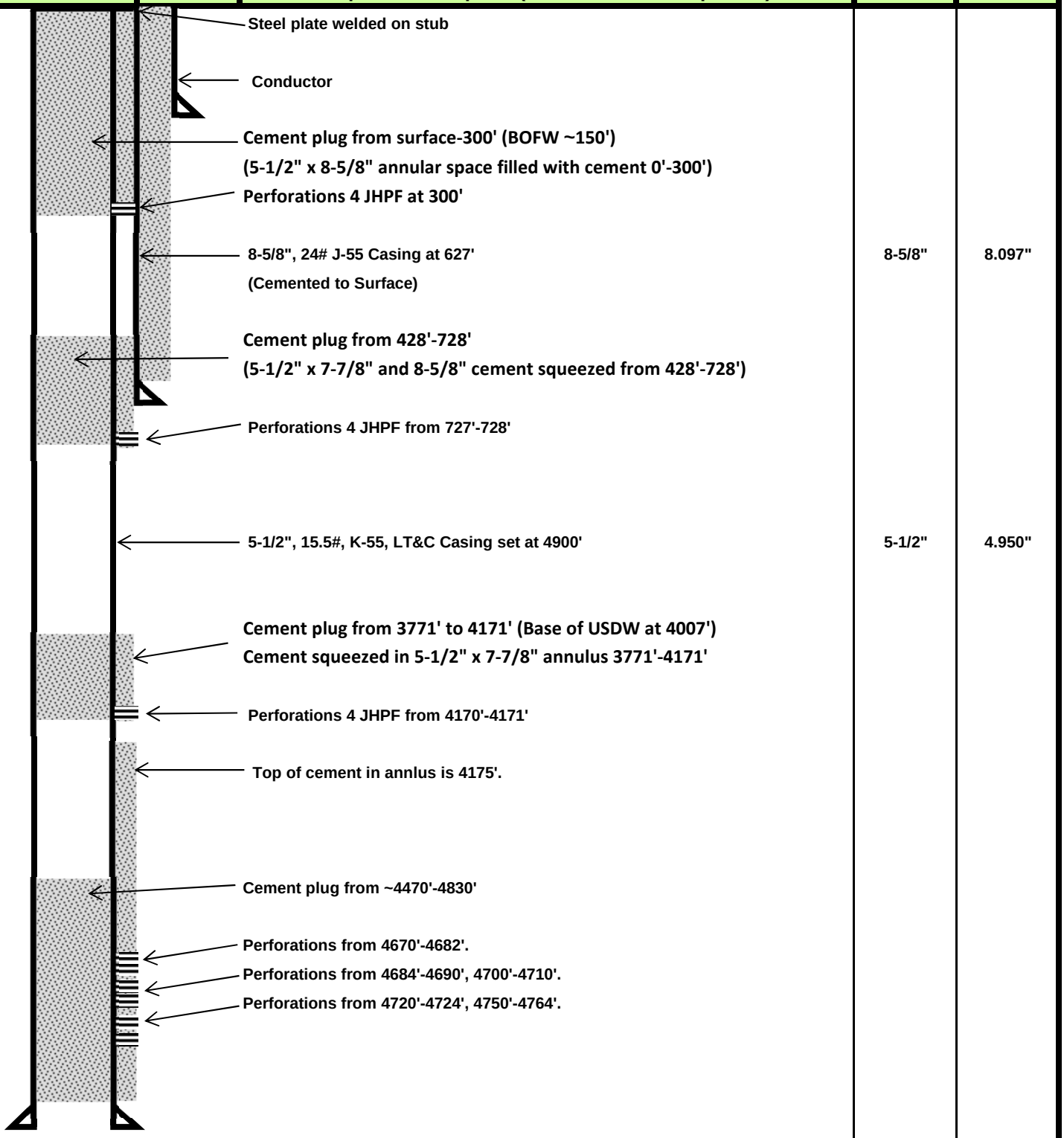
Attachment Q-7

PG&E

Piacentine 1-27 (API No. 077-20484) Abandonment WBD Scenario 3
San Joaquin, California
Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -6.5' ground, +6.5' KB. All the measurements are from KB which is 13' above ground.



Installation	Depth & Description (after Planned Completion)	OD	ID
	8-5/8", 24# J-55 Casing at 627' (Cemented to Surface)	8-5/8"	8.097"
	5-1/2", 15.5#, K-55, LT&C Casing set at 4900'	5-1/2"	4.950"

Prepared by Irani Engineering 4/5/2014

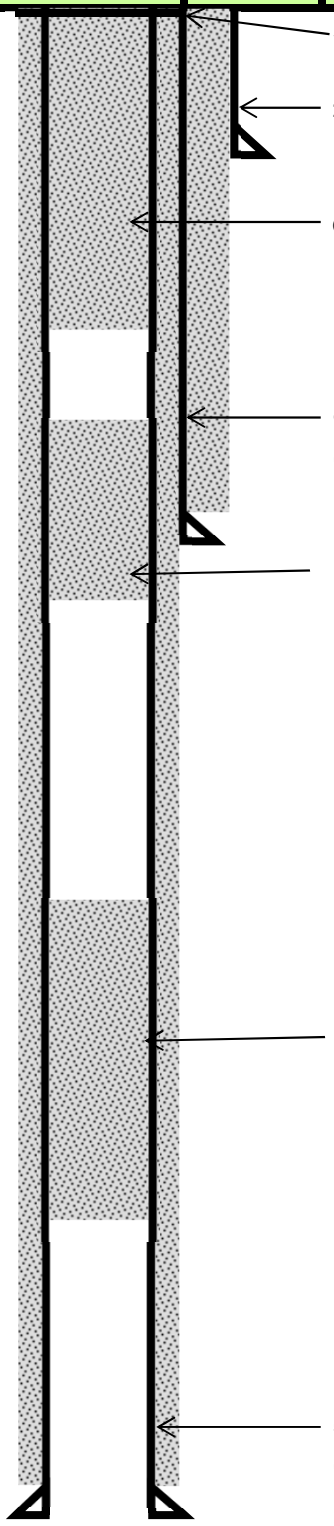
Attachment Q-7

PG&E

Piacentine 2-27 (API No. 077-20736) Abandonment WBD
San Joaquin, California
Sec 27, T 3N, R 5E

Location: Section 27, T 3N, R 5E, San Joaquin, California.

Elevation: -4.5' ground, +7.5' KB. All the measurements are from KB which is 12' above ground.



Installation	Depth & Description (after Planned Completion)	OD	ID
	Steel plate welded on stub		
	16" Conductor at 60'		
	Cement plug from 300' to surface (base of fresh water at ~150')		
	9-5/8", 36# J-55 STC Casing at 614' (12-1/4" hole) (Cemented to Surface with 280 Sacks)	9-5/8"	8.921"
	Cement plug from 514' to 714'		
	Cement plug from 4100' to 3700' (base of USDW at 3998.5', top of) cement must be above 3898'.		
	5-1/2", 15.5#, J-55, LT&C Casing set at 4969' (Cemented to Surface with 1180 Sacks)	5-1/2"	4.950"
	PD=~4920' TD=4970'		

Prepared by Irani Engineering 1/2/2014

ATTACHMENT R

Necessary Resources

R.1 REQUIREMENTS

This section requires the applicant to submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.

R.2 RESPONSE

PG&E Corporation is an energy-based holding company headquartered in San Francisco. It is the parent company of Pacific Gas and Electric Company (PG&E), which is one of the largest combined electric and gas utilizes in the United States. PG&E is a publicly listed company that is required to publish audited annual and quarterly financial reports (that include detailed financial statements). Those reports are available to the public at the following website from the fourth quarter of 2012 back to 2001: http://www.pgecorp.com/investors/financial_reports/.

We understand that EPA has indicated the requirements for financial assurance may be changing and that PG&E may be required to provide additional documentation. We also note that EPA has indicated that the pending changes would not preclude EPA from determining that our application was administratively complete.

ATTACHMENT T

List of Permits and Construction Approvals

T.1 REQUIREMENTS

The UIC regulations require a list of any existing EPA permits including program and permit number, for example, National Pollution Discharge Elimination System (NPDES) permit for water discharges, Potential for Significant Deterioration (PSD) permits for air emissions, Resource Conservation and Recovery Act (RCRA) permits for hazardous waste generation, transfer, storage or disposal, and other permits. In addition, EPA has requested a list of any permits and construction approvals received or applied for under various programs, including state and local programs. Confirmation was also requested documentation that the UIC permit application had been provided to the appropriate State of California regulatory agencies, including the California Regional Water Quality Control Board (RWQCB) and the Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR).

T.2 RESPONSE

The project currently holds no Federal, State or Local permits. The following applicable permits have been applied for, or will be obtained prior to project implementation:

- Department of Energy (DOE) is serving as the lead agency for National Environmental Policy Act (NEPA) compliance for the proposed project. A draft Environmental Assessment (EA) was issued for public comment on November 26, including distribution to EPA, and the review period was closed as of December 31. No comments were received during the review period. The EA includes analysis of historic resources and protected species and fulfills the consultation requirements of Section 106 and Section 7 of the respective laws. A copy of the Final EA and Finding of No Significant Impact (FONSI) published by DOE is expected to be available by the middle of February 2014 and will be provided to EPA.
- Prior to beginning field work, a NPDES Construction Storm Water Permit will be obtained from the State Water Resources Control Board.
- An encroachment permit will be obtained from Reclamation District 2044 for use of the levee road on the west bank of Bishop Cut Slough north of 8-Mile Road to access the site.

Permitting inquiries have been made with the following additional agencies:

- San Joaquin County Community Development Department was briefed on the project and indicated they will not require a grading or Improvement Plan approval for a temporary project of this size and nature.
- The San Joaquin Valley Air Pollution Control District was briefed on the project and indicated they believe the project will fall under their Research Project Exemption (Rule 2021), and will not require an air emissions permit. A letter will be issued by the District presenting the results of their review and stating any requirements that will apply to the project, such as emissions monitoring and reporting. Abatement or other permitting requirements are not anticipated to

be applied, and emissions monitoring requirements are expected to be satisfied by the proposed monitoring and sampling procedures proposed for withdrawn air that are described in Attachment P.

- The DOGGR has indicated that installation of an injection/withdrawal well for the purpose of injecting or withdrawing air does not fall under their jurisdiction. A copy of the UIC permit application package submitted to EPA and correspondence relating to the UIC permit application has been sent to the following contact:

  Michael L. Woods
  District Deputy
  Department of Conservation
  Division of Oil, Gas, and Geothermal Resources
  801 K Street, 20th Floor, MS 20-22
  Sacramento, CA 95814
  Telephone: (916) 322-1110
  Email: mike.woods@conservation.ca.gov

- Drilling mud will be disposed at Aqua Clear Farms in Rio Vista, and produced water will be removed from the site and disposed by ASTA Construction, a company specializing in the management of produced water, and disposed at their injection wells in Rio Vista, California. Copies of the permits for ASTA's injection wells were requested from ASTA; however, the permits have not yet been provided. Once PG&E receives the permits, they will be presented to EPA for review. Since the produced water will be disposed of in ASTA's permitted injection wells at Rio Vista, and there will be no discharges of water or waste to the land surface, surface water or groundwater at King Island, the project does not require a permit from the Regional Water Quality Control Board (RWQCB). A courtesy copy of the UIC permit application and correspondence relating to the UIC permit application has been sent to the following contact at the RWQCB:

  Anne L. Olson, P.E.
  Senior Water Resource Control Engineer
  Central Valley Regional Water Quality Control Board
  11020 Sun Center Drive, Suite 200
  Rancho Cordova, CA 95670
  Telephone: (916) 464-4740
  Email: Anne.Olson@waterboards.ca.gov

ATTACHMENT U

Description of Business

U.1 REQUIREMENTS

This section requires the applicant to provide a brief description of the nature of the business.

U.2 RESPONSE

PG&E is California's largest investor-owned gas and electric utility.

The United States Department of Energy (DOE) and the California Public Utilities Commission (CPUC) have funded PG&E's Compressed Air Energy Storage (CAES) project to demonstrate the viability of advanced, underground CAES technology and accelerate the technology's market readiness in the U.S. As such, the project will investigate the viability of using a porous rock formation, such as a depleted natural gas field, as an underground storage reservoir. During times of excess generation, when abundant renewable energy is expected to be available, electricity will be used to inject compressed air into the subsurface reservoir; that air would then be withdrawn/recovered during times of high demand and used to generate electricity using turbo-generation equipment. CAES has been identified as a high potential enabling technology for the expanding reliance on renewable resources for electricity production.

The project proposed under this permit application consists of the installation of an injection-withdrawal well and performance of air injection and withdrawal testing to evaluate the viability of the identified reservoir. Under a prior phase of the CAES project completed in April 2013, a core well was drilled at the proposed project site to investigate reservoir geologic characteristics.