REPORT OF FINDINGS
WRGS 16-004

Hydrogeologic Report of the Needmore Water, LLC

Well D

for

Needmore Water, LLC
3900 McColl Rd.
McAllen, Texas 78501

Hays County, Texas

March 2016

WRGS Project No. 079-001-15

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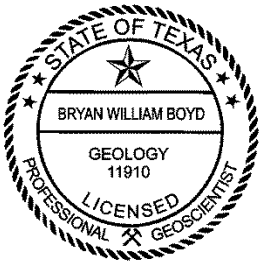

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Section I: Executive Summary

This report details the results of hydrogeologic testing of the Middle Trinity Aquifer performed to meet the guidelines set forth by the Barton Springs/Edwards Aquifer Conservation District (BSEACD). Needmore Water, LLC (Needmore Water) submitted applications pursuant to amendments to the BSEACD's enabling legislation mandated by the Texas Legislature pursuant to House Bill (HB) 3405, effective June 19, 2015. The applications sought issuance of temporary and regular production permits for the existing Well D, which is located on the Needmore River Ranch, LLC (Needmore) in southern Hays County. Needmore Water will utilize the water produced from the Middle Trinity Aquifer for irrigation, stock and wildlife watering, and recreational uses, all statute defined beneficial purposes on the ranch. Needmore Water's applications seek authorization to produce 289,080,000 gallons per year (approximately 887 acre-feet/year; 550 gallons per minute (gpm)) from Well D. This volume of production was based upon the Maximum Production Capacity of Well D which was calculated based upon the construction specifications of the well and prior aquifer testing performed, November 14, 2012 and incorporated herein by reference for all purposes as Appendix A. The well is located in the central portion of the ranch property which is located along Fulton Ranch Road approximately 7 miles northwest of the City of San Marcos.

Needmore Water was granted a temporary production permit for 179,964,440 gallons per year (552.3 acre-feet/year; approximately 342 gpm) from BSEACD based upon BSEACD staff's interpretation of the language in HB 3405 of the 84th Texas Legislature. However, the volume granted for the temporary production permit was below what Needmore Water applied for based upon the "Maximum Production Capacity" of Well D as that term is legislatively defined in HB 3405. Well D was completed in February 2013, prior to HB 3405 being enacted by the 84th Texas Legislature in May of 2015. A copy of the District's letter laying out its analysis (rationale for reducing Needmore's application) is attached as Appendix B.

The well site is within a valley located near the wet weather Sycamore Creek. The creek valley is dominated by natural vegetation and rocky terrain with limestone outcroppings. Projected annual pumping demands for the next three years were estimated at an equal amount of 72.27 million gallons per quarter, however, the demand could vary depending upon weather conditions and ranch activity, *e.g.*, livestock counts. Peak irrigation demand hours are projected for the early morning hours to reduce water loss due to evapotranspiration and heat.

The two major aquifers located within Hays County are the Edwards Aquifer and the Trinity Aquifer. These two aquifers make up a thick and regionally extensive aquifer system composed of Lower Cretaceous carbonates that were deposited throughout central Texas. The lower of the two aquifers, the Trinity Aquifer is composed of three distinct aquifers: the Upper, Middle, and Lower Trinity Aquifers. Well D sets atop a relatively thin portion of the Edwards Group along the Hidden Valley Fault. A suite of geophysical logs (gamma ray, spontaneous potential, 4-point resistivity, and caliper) were performed on Well D during the well construction on October 23, 2012, to determine the formation thickness and fracture locations within the borehole. Typically, the highest yielding portion of the Trinity Aquifer is the Middle Trinity, specifically the Cow Creek Limestone Member of the Travis Peak Formation in the lower portion of the Middle Trinity Aquifer. This formation is, in some localities, a heavily fractured limestone, making it more productive because of its enhanced ability to transmit groundwater. At the site of Needmore Water's Well D, the major producing zone is the Cow Creek Limestone.

A well site investigation was conducted on January 28, 2016, which indicated that no known recharge features or springs that affected the Middle Trinity Aquifer were present within a one mile radius of Well D. The Blanco River is a major surface water body located in proximity to Well D, however, it does not directly influence Well D. Groundwater produced from Well D is not classified as "groundwater under the influence of surface water."

Two minor seeps were noted approximately 3/4 of a mile to the northwest and 2/3 of a mile to the northeast of Well D during the field investigation, and most likely issue from the thin layer of Edwards Formation in the area of Well D. Additionally, Fern Bank Springs is located outside of the 1-mile investigation area to the northeast of Needmore. Fern Bank Springs is a documented Edwards Aquifer Spring, and is not connected to the Middle Trinity Aquifer or impacted by Well D.

An aquifer test was conducted on Well D to demonstrate the ability to provide water to the Needmore River Ranch and satisfy BSEACD's aquifer testing requirements at the production capacity described in the Application. During the aquifer test, Well D was pumped for over 120 hours at an average rate of 544 gpm with 35.3 feet of drawdown, resulting in a specific capacity of 15.4 gpm/ft. Aquifer properties were calculated using the Cooper-Jacob, Theis, and Theis Recovery methods. Transmissivity values using the Cooper-Jacob (4,000 $ft.^2$/day), Theis (4,050 $ft.^2$/day) and Theis Recovery (4,070 $ft.^2$/day) methods resulted in similar values. Average storativity values using the Cooper-Jacob (1.0×10^{-4}) and Theis (2.26×10^{-4}) methods also had good agreement. The average transmissivity at Well D (4,040 $ft.^2$/day) and average storativity values (1.63×10^{-4}) were used to model drawdown at one (1) and three (3) years utilizing the Theis equation to meet mandated BSECD guidelines.

The accurate estimation of water levels due to pumping within a karst aquifer such as the Middle Trinity Aquifer over long term periods of production is difficult. Karst includes some of the world's most impressive landscapes, but they are also some of the most challenging in terms of groundwater and engineering problems (Palmer and others, 1999). The heterogeneic character of the karst aquifer, in addition to potential disconnects between the Cow Creek Member and other formations, causes traditional methods of estimating drawdown, such as the Modified non-equilibrium equation (Theis equation), to overestimate drawdown.

Since the Theis equation assumes (i) that all water is derived from storage and (ii) that the aquifer receives no recharge, Theis overestimates drawdown within a well that is located in an aquifer that receives recharge rapidly such as the Middle Trinity. For this reason, using the Theis equation to calculate drawdown over periods of time greater than when water from capture exceeds water from storage leads to an exaggerated estimate of drawdown. To satisfy the BSEACD requirements, however, distance-drawdown calculations for 1 and 3 years using the Theis equation were conducted. At one year and three years, the drawdown at Well D was estimated at 55.28 ft. and 57.57 ft., respectively.

During the aquifer testing, precipitation and stream flow on the Trinity Aquifer recharge zone from rain gauges and flow stations were monitored in addition to the discharge rate from Jacob's Well Spring to determine potential influences from pumping Well D. The stream flow and spring hydrographs included in this report in Figures 20 and 21 indicate no observable influence from the pumping of Well D.

Water quality parameters prescribed in BSEACD protocols were conducted. Resulting water quality analysis were outlined in the aquifer test work plan and approved by BSEACD staff. The Total Dissolved Solids (TDS) concentration measured during the Well D aquifer test was 1,000 mg/L with a sulfate concentration of 507 mg/L. In general, the concentration levels for each of the constituents analyzed fall within the expected range for groundwater produced from Middle Trinity Aquifer. No negative impacts to water quality are anticipated with prolonged production from Well D.

Section II: Introduction

This report details the results of a hydrogeologic report of Well D to meet the guidelines mandated by the Barton Springs/Edwards Aquifer Conservation District (BSEACD) for a regular production permit application filed pursuant to HB 3405. Needmore Water, LLC (Needmore Water) is submitting a regular production permit application for the existing Well D which is located on the Needmore River Ranch, LLC (Needmore) in southern Hays County (Figure 1). Needmore will utilize the water produced from the Middle Trinity Aquifer for irrigation, stock and wildlife watering and recreational uses on the ranch. Needmore Water is seeking to produce 289,080,000 gallons per year (approximately 887 acre-feet/year; 550 gallons per minute (gpm)) from Well D. The well is located in the central portion of the ranch property which is located along Fulton Ranch Road approximately 7 miles northwest of the City of San Marcos (Figure 1).

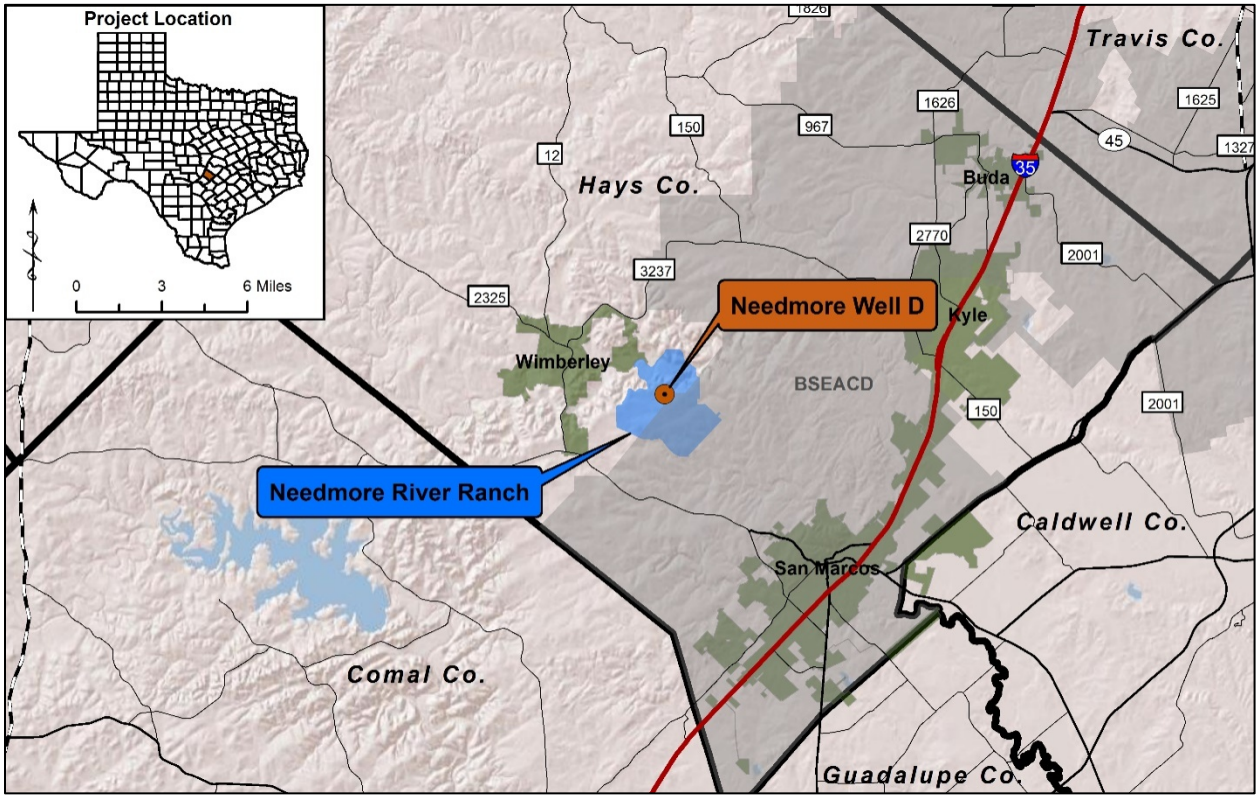


Figure 1: Location map of the Needmore River Ranch Well D

Needmore Water was granted a temporary production permit for 179,964,440 gallons per year (552.3 acre-feet/year; approximately 342 gpm) from BSEACD based upon BSEACD staff's interpretation of language in House Bill (HB) 3405 of the 84th Texas Legislature (*see* Appendix C). However, the volume granted for the temporary production permit was below what Needmore Water applied for based upon the Maximum Production Capacity of Well D as defined in HB 3405. Well D was completed in February 2013 prior to HB 3405 being enacted by the 84th Texas Legislature in May of 2015, and was an "Existing Well" on the effective date of this legislation, June 19, 2015.

Acquisition of a regular production permit from BSEACD requires an acceptable aquifer test and a hydrogeologic report for the well. Aquifer testing and report parameter guidelines laid out in the

"Guidelines for Hydrogeologic Reports and Aquifer Tests Conducted Within the Jurisdictional Boundaries of the Barton Springs/Edwards Aquifer Conservation District" (2007) were used to structure this hydrogeologic report pursuant to BSEACD mandate. The aquifer testing procedures were closely coordinated with BSEACD to ensure an accurate assessment of the hydrogeologic properties of the Trinity Aquifer at the well site.

The objectives of this report are to support Needmore Water's application for a regular production permit authorizing production of up to 887 acre-feet/year, by demonstrating the following:

1. Provide a detailed description of the project to include location, pumping demands, pumping schedules (frequency, peak demand hours, and pumping rates), and the location and volume of the irrigation water needed;

2. Describe the geologic and hydrogeological properties of the Trinity Aquifer in the area of the Needmore River Ranch;

3. Take an inventory of potential recharge and discharge locations influencing or being influenced by the Well D;

4. Design, perform, and analyze the results of an 120-hour aquifer test for Well D; and

5. Report water quality sample results, evaluate future water level impacts, and assess potential water quality impacts from Well D production.

Section III: Description of the Well Site and Water System

III.1. Introduction

Needmore Well D is centrally located within Needmore River Ranch which is a tract of approximately 5,000 acres located on Fulton Ranch Road in Hays County (Figure 2). All of the property is owned by Needmore River Ranch, LLC (Special Warranty Deed; Document No. 2013-13029542, Official Public Records of Hays County, TX). The Groundwater Rights have been leased to the Needmore Water, LLC. The majority of the Ranch is undeveloped land with natural vegetation. Needmore has long term plans to develop the ranch land for livestock raising and supporting agricultural activities, *e.g.*, pastures and cultivated fields, oats, etc., and irrigate portions of the ranch property for agricultural, livestock and wildlife purposes, as well as recreational purposes.

III.2. Well Site and System Details

The Well D site is within a valley located near the wet weather Sycamore Creek (Figure 2). The creek valley is dominated by natural Central Texas Hill Country vegetation and rocky terrain with limestone outcroppings. The water produced from Well D will travel within a 6-inch pipeline approximately 0.4-miles at which point it discharges into Sycamore Creek (Figure 2). Thereafter, the water flows within the natural creek bed to a water storage pond at the mouth of the valley (Figure 2).

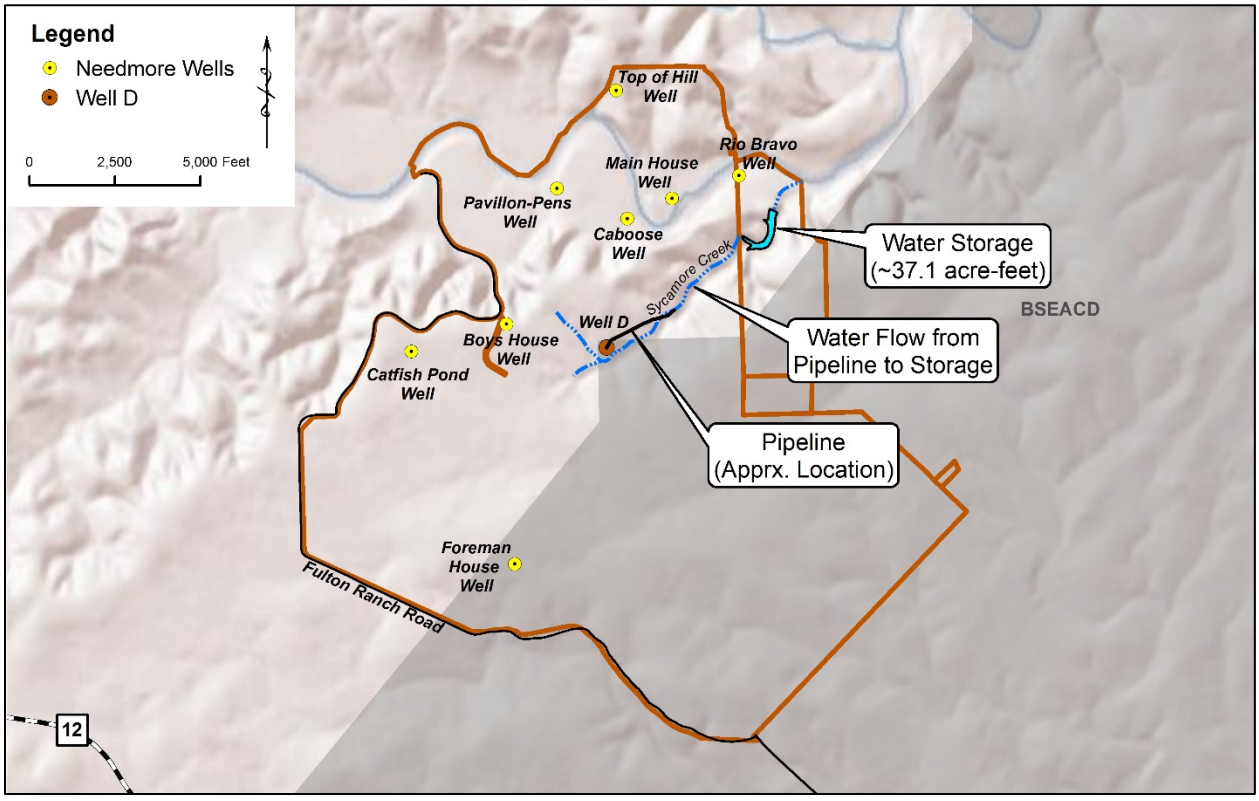


Figure 2: Needmore facilities map

Figures 3 and 4 (A - D) show aerial and field photos of the area near the Well D site; the field photo (Figures 4A - 4D) locations are designated on the map in Figure 3. Photo A was taken near Well D

looking across Sycamore Creek to the south with the foreground showing the shallow top soil over Edwards Limestone. Photo B was taken in the Sycamore Creek channel looking to the west and provides an example of the weathered limestone that dominates the area. Photo C was taken from the Sycamore Creek channel looking north. Well D can be seen in the background. Photo D was taken from the south side of Sycamore Creek looking at Well D.

There are a total of nine (9) wells on the Needmore property, 8 domestic/exempt wells (Figure 2 – yellow circles) and Well D (Figure 2 – orange circle). The majority of the wells (Top of the Hill, Rio Bravo, Main House, Caboose, Pavilion-Pens, Boys House, and Catfish Pond Wells) are located within the Hays-Trinity Groundwater Conservation District (HTGCD) and are registered with HTGCD. The Foreman House Well and Well D are the only wells on the Needmore property that are within the BSEACD jurisdictional boundaries. The groundwater produced from Well D will be utilized for agricultural irrigation, livestock crop irrigation, and livestock/wildlife uses. The water has been used via a 6-inch pipeline to Sycamore Creek which feeds a storage pond that has a surface area of approximately 7.4-acres (Figure 2). The average depth of the pond which encompasses the lower portion of the Sycamore Creek stream bed was estimated at 5 feet (ft.) for an approximate volume of 37-acre-feet.

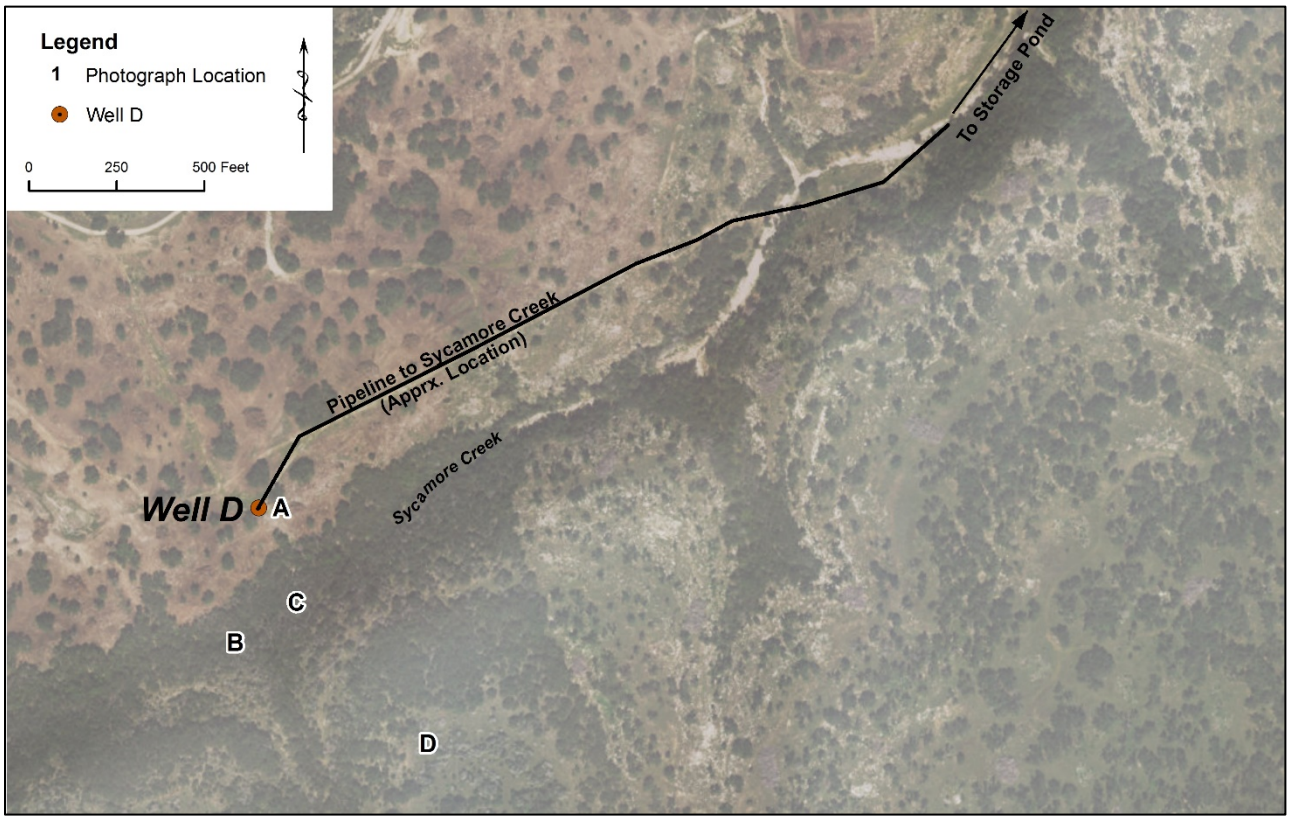


Figure 3: Well site schematic

Figure 4: Photos from well site area – 1) Looking south from Well D; 2) looking southwest up Sycamore Creek; 3) looking north from creek bed towards Well D; 4) looking north towards Well D from south side of Sycamore Creek

Table 1: Water storage facilities at Needmore River Ranch

Storage Facility	Surface Area (acres)	Average Depth (ft.)	Volume (acre-feet)
Water Storage Pond	7.4	5	37.0
Total (acre-feet)			37.0

The irrigation schedule for water to be produced from Well D in the future will be dependent upon multiple factors, including the number of cultivated acres, soil conditions, crops selected and crop rotation practices, as well as weather conditions, *e.g.*, precipitation and evapotranspiration. Peak irrigation demand hours are projected for the early morning hours to reduce water loss to evapotranspiration and heat. Projected annual pumping demands for the next three years were estimated and summarized in Table 2. The demand, however, could vary depending on the factors identified, particularly weather conditions.

Table 2: Estimated pumping projections

Pumping Year	Estimated Pumping Volume for Quarter 1 (MG)	Estimated Pumping Volume for Quarter 2 (MG)	Estimated Pumping Volume for Quarter 3 (MG)	Estimated Pumping Volume for Quarter 4 (MG)	Total Annual Production Volume (MG)
No. 1	72.27	72.27	72.27	72.27	289.1
No. 2	72.27	72.27	72.27	72.27	289.1
No. 3	72.27	72.27	72.27	72.27	289.1
Percentage of Permit	**25.0%**	**25.0%**	**25.0%**	**25.0%**	**100.0%**

Section IV: Geology and Aquifer Description

IV.1. Introduction

The two major aquifers located within Hays County are the Edwards Aquifer and the Trinity Aquifer. These two aquifers make up a thick and regionally extensive aquifer system composed of Lower Cretaceous carbonates that were deposited throughout central Texas. On the Edwards Plateau in northwestern Hays County, the regional dip of the Cretaceous rocks is generally about 70 feet per mile to the southeast, which is the approximate gulfward slope of the land surface. Southeast of the Balcones Fault Zone (BFZ) the dip is progressively greater toward the Gulf, approaching 100 feet per mile (DeCook, 1963).

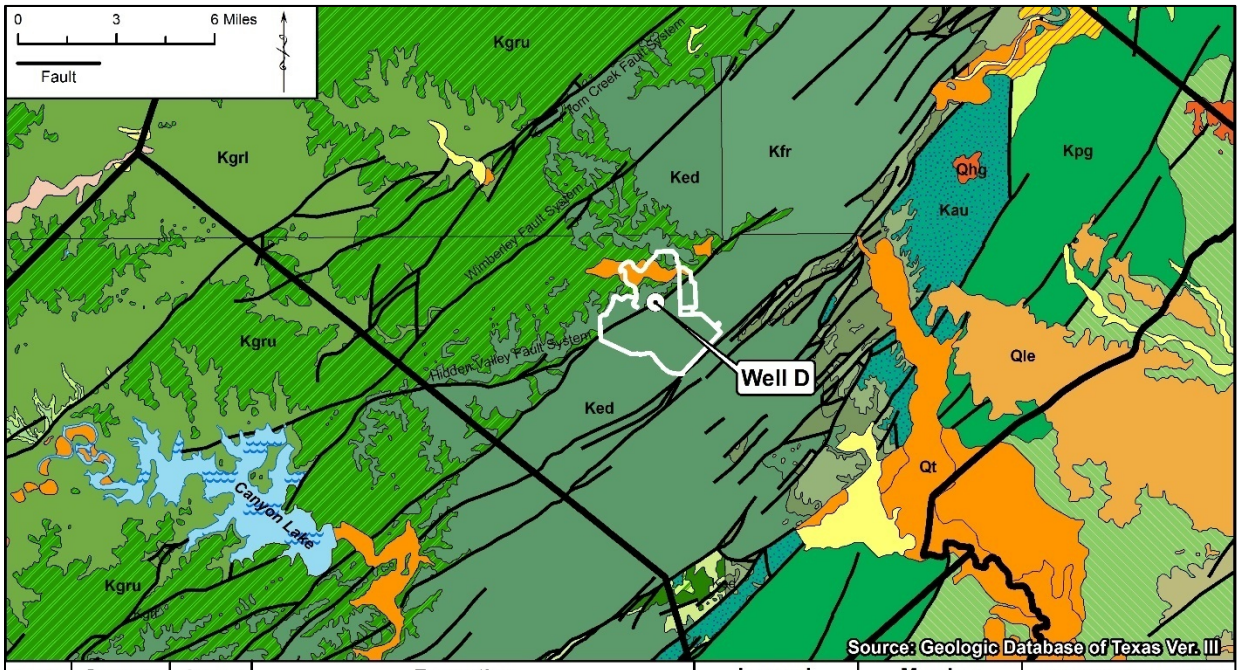
The lower of the two aquifers, the Trinity Aquifer is composed of three distinct hydrogeologic units: the Upper, Middle, and Lower Trinity Aquifers. The Upper Trinity Aquifer, composed of the Upper Glen Rose Limestone, is overlain by the limestone and dolomite of the Edwards Aquifer in the southeast portion of the county. In Hays County, the BFZ is the most influential structural occurrence, and has significantly altered the area hydrogeology.

IV.2. Stratigraphy and Geologic History

The well location is situated in south central Hays County, where the Balcones Fault Zone dominates the local geologic and hydrogeologic properties. The BFZ is a series of normal en-echelon faults that trend in a general northeast-to-southwest direction extending from Williamson County in the northeast to Kinney County in the west. In the immediate vicinity of the well, the Hidden Valley Fault System is present which is part of the BFZ (Figure 5). Faulting in the area associated with the BFZ has caused some rock units to be upthrown against others, creating both barriers to flow and conduits for water to pass through. The San Marcos arch or platform, as described by Adkins (1933), is a broad anticlinal extension of the Llano uplift extending toward the City of San Marcos in Hays County, and has had significant impacts on the deposition of overlying sediments (Ashworth, 1983). Figure 5 illustrates the regional geologic and hydrogeologic units encountered within and in the vicinity of Well D location.

The Trinity Aquifer is divided into three distinct aquifers from oldest to youngest: the Lower, Middle and Upper Trinity Aquifers. Formations comprising the Lower Trinity Aquifer include, from oldest to youngest, the Hosston Sand Member and Sligo Limestone Member of the Travis Peak Formation (Figure 5). The Hosston consists of a conglomerate of gravel, sand and clay cemented by both calcite and quartz. The Hosston also contains sections of sandstone, siltstone, claystone, dolomite, limestone and shale. The Sligo Limestone consists of clastic sediment near the project location, and becomes dominantly limestone and dolomite to the east. Surface outcrops are referred to in the literature as Sycamore; Hosston and Sligo are the subsurface equivalents.

Located stratigraphically above the Hosston Sand is the Hammett Shale (Hammett Clay) Member. The Hammett Clay is a transgressive shale deposit that onlaps Lower Trinity Sligo and Hosston formations. The interval averages 60 feet in thickness in the Hays County area (Brune and Duffin, 1983). The unit is primarily a clay rich, gray-green sticky, dolomitic shale/claystone with siltstone and dolomite lenses. Color can be dark gray to black, blue, greenish gray and gray. The Hammett Clay is a confining bed separating the Lower Trinity Aquifer from the Middle Trinity Aquifer (Figure 5). Confining beds, when present, restrict the flow of groundwater between aquifers.



ERA	System	Group	Formation	Legend	Member	Hydrogeologic Unit
Cenozoic	Quaternary to Neogene		Pliocene to Recent floodplain (alluvium and fluviatile terrace deposits)	Qa, Qat, Qt, Qhg, Qle, Qo		localized alluvial aquifers
Mesozoic	Upper Cretaceous	Navarro/ Taylor	Marlbrook Marl	Kknm		confining beds
			Pecan Gap Chalk	Kpg		
			Ozan (Lower Taylor Marl)	Ko		
		Austin	Austin Chalk Lmst.	Kau		localized fractured limestone aquifer
		Eagle Ford	Eagle Ford Shale	Kef, Keb		confining beds
		Washita	Buda Lmst.	Kbu, Keb		
			Del Rio Clay	Kdr, Kdg		
			Georgetown Lmst.	Kgt, Kdg		
	Lower Cretaceous	Edwards	Person	Ked	Marine; Leached & Collapsed; Regional Dense; Grainstone	Edwards Aquifer
			Kainer		Kirschburg evaporite; Dolomite Mbr.; Burrowed Mbr.; Basal Nodular Bed	
		Trinity	Glen Rose Lmst.	Kgru	Upper Mbr.	Upper Trinity Aquifer
				Kgrl	Lower Mbr.	Middle Trinity Aquifer
			Travis Peak	Kh, Kcc, Kch	Hensell Sand; Bexar Shale; Cow Creek Lmst.	
				Kha	Hammett Shale	confining bed
				Ksy	Sligo Lmst.; Hosston Sand	Lower Trinity Aquifer

Figure 5: Geologic map with stratigraphic column (modified from Ashworth, 1983; Maclay and Small, 1986)

Above the Hammett Clay lies the Middle Trinity Aquifer composed of the Cow Creek Limestone and the Bexar Shale Members of the Travis Peak Formation and the Lower Glen Rose Limestone Member of the Glen Rose Formation (Figure 5). The Cow Creek Limestone is a massive, fossiliferous limestone and dolomite ranging up to 100 feet in thickness and may contain some interbedded sand, clay, and evaporite minerals such as gypsum and anhydrite (Ashworth, 1983; Brune and Duffin, 1983; Preston et. al, 1996). The formation was subaerially exposed and subjected to meteoric water infiltration during early Hensel time, which resulted in widespread vuggy porosity (Loucks, 1977). In some areas, the Cow Creek is heavily fractured and capable of producing large well yields.

Overlying the Cow Creek Member is the Hensell Sand Member (Figure 5), which in the outcrop, is composed of loose sand and grades into thick continental deposits of red clay, silt, sand, and conglomerate with limestone beds in the subsurface. Downdip, the Hensell grades into marine deposits of silty dolomite, marl, calcareous shale, and shaley limestone known as the Bexar Shale Member (Ashworth, 1983). Downdip, the Bexar Shale acts as a confining unit for the Cow Creek Member (Wierman et al., 2010).

Stratigraphically above the Hensell Sand/Bexar Shale, the Glen Rose Limestone Formation is divided into an Upper and Lower Member (Figure 5). The Glen Rose Limestone, along with the Hensell Sand represents a wedge of sediments deposited in a transgressing sea. George (1952) separated the Glen Rose into upper and lower members. The boundary between the two members is identified by a thin, heavily fossfiliferous limestone bed containing *Corbulamartinae* that persists throughout the study area except where erosion has lowered the land surface below the bed (Whitney, 1952; Ashworth, 1983). The separation between the two units is also distinguishable on geophysical logs where two distinct evaporite zones are found within the Upper Glen Rose; one midway through the Upper Glen Rose and another near the base shown by resistivity spikes on a geophysical log. The lower member of the Glen Rose Limestone consists of a massive, fossiliferous limestone at the base grading upward into thin beds of limestone, dolomite, marl, and shale. The top 15 to 20 feet of the lower member, designated the *Saleniatexana* zone, is a highly fossiliferous, nodular marl and limestone which is capped by the Corbula bed (Ashworth, 1983). Near the top of the Lower Glen Rose, in some locations, is a reef deposit that is cavernous, heavily fractured, and can range in thickness. Where the reef deposit is encountered, the Lower Glen Rose Member can provide high yielding wells.

The Upper Member of the Glen Rose Formation, comprising the Upper Trinity Aquifer, consists of alternating beds of limestone and dolomite with marly sections that act as aquitards and restrict downward migration of groundwater to the Middle and Lower Trinity Aquifers (Wierman et al., 2010). The Upper Glen Rose also contains two distinct evaporite beds of gypsum or anhydrite that are easily distinguishable on geophysical logs due to high resistivity values. The lower evaporite zone occurs at the base of the Upper Glen Rose, which Ashworth (1983) describes as a “convenient correlation marker” between the Upper and Lower Glen Rose. The evaporite beds in some cases are the source of elevated sulfate concentrations in groundwater. The Upper Trinity Aquifer can yield small to moderate amounts of water to shallow wells which are often utilized for livestock and domestic use.

The Edwards Aquifer is comprised of three geologic formations, from oldest to youngest: the Kainer and Person formations (Edwards Group), and the Georgetown Formation (Washita Group; Figure 5). These formations were formed during the Cretaceous period during which the San Marcos Platform depositional environment varied from open marine to supratidal flats, where significant exposure and

inundation of the sediments took place (Rose, 1972). At the base of the Edwards Group lies the Kainer Formation, which is comprised of the basal nodular bed, dolomitic, and grainstone members. The basal nodular member (Walnut Clay equivalent) is a marine deposit consisting of massive, nodular wackestones and has a low permeability. The dolomitic member consists mostly of intertidal and tidal, burrowed and dolomitized wackestones with significant permeability. The upper part of the dolomitic member contains leached evaporitic deposits of the Kirschberg evaporite. The uppermost member of the Kainer Formation is the grainstone member, which is a shallow marine deposit that marks the beginning of another cycle of sedimentation started by a transgressing sea. This member consists of well-cemented, miliolidgrainstones with lesser quantities of mudstone (Maclay and Small, 1986). The upper stratigraphic unit of the Edwards Group is the Person Formation, which consists of the regional dense, collapsed, leached, and marine members (Rose, 1972). The basal member is a laterally extensive marine deposit consisting of dense, shaley mudstone known as the regional dense member. The overlying members, the collapsed member and leached member, consist of intertidal to supratidal deposits containing permeable units formed by collapse breccias and by dolomitized and burrowed wackestones. The uppermost member is the marine member, which consists of rudist-bearing wackestones and packstones and shell-fragment grainstone (Maclay and Small, 1986).

Overlying the Edwards Group, the Georgetown Limestone Formation of the Washita Group is composed of stratigraphically distinct limestone and is generally of lower porosity than the Edwards. The Georgetown Formation is included in the Edwards Aquifer because there is no barrier preventing communication with the Edwards Group and the Georgetown expresses similar karstic characteristics as the Edwards (Scanlon et al., 2002; Lindgren et al., 2004). The end of deposition of the Georgetown Formation was marked by a period of subaerial erosion and karstification, after which the Del Rio Clay and Buda Limestone were deposited during the Upper Cretaceous (Figure 5). The Del Rio Clay is a dark bluegreen to yellow-brown, variably gypsiferous clay commonly containing fossilized clams and oysters (Hanson and Small, 1995). The overlying Buda Limestone consists of dense, variably nodular, sublithographic or "porcelaneous" limestone and buff, light-gray mudstone, commonly containing calcispheres and tiny calcite-filled fractures (Sellards and others, 1933; Hanson and Small, 1995). The Eagle Ford Group overlies the Buda Limestone and consists of thin flagstones of brown, flaggy sandy shale and clayey limestone. Some of the freshly fractured flagstones (thin brittle slabs) emit a petroliferous odor. Because the Eagle Ford Group is dark brown in the subsurface, local water-well drillers commonly refer to this shale as lignite (Hanson and Small, 1995). The Austin Group overlies the Eagle Ford Group and consists of chalky, variably marly, generally fossiliferous limestone and is capable of producing small quantities of seasonal groundwater.

Well D sits atop a relatively thin portion of the Edwards Group along the Hidden Valley Fault (Figure 5). A suite of geophysical logs (gamma ray, spontaneous potential, 4-point resistivity, and caliper) were performed on Well D to determine the formation thickness and fracture locations within the borehole. Figure 6 provides a well log profile showing construction details, geophysical data, lithology, and hydrostratigraphy at Well D. According to the geophysical log, the Edwards Aquifer is present from ground surface to 89 feet below ground surface (ft. bgs), the Upper Trinity Aquifer is present from 89 ft. bgs to 468 ft. bgs, and the Middle Trinity Aquifer is present from 468 ft. bgs to 798 ft. bgs. The Middle Trinity Aquifer is under confined conditions. Confined groundwater is isolated from the atmosphere at the point of discharge by impermeable geologic formations, and the confined aquifer is generally subject to pressures higher than atmospheric pressure (Driscoll, 1986). Figures 7 and 8 show conceptual cross sections of the study area from west to east (A-A') and north to south (B-B').

Geophysical logs [performed 2011 and 2012] from six Needmore Wells were analyzed and utilized to construct the cross sections. Three of the geophysical logs were from existing wells (Well D, Top of the Hill Well, and Catfish Pond Well) completed in the Middle Trinity Aquifer that were utilized in the aquifer testing while three test wells (Test Wells A, B, and C) were never completed and were plugged and abandoned in 2012. The cross-sections include the static water level prior to the aquifer test, the maximum pumping water level, and the estimated pumping water level after three years of pumping at Well D for Top of the Hill Well, the Catfish Pond Well, and Well D. Appendix D provides copies of the geophysical logs with formational picks.

Client: Needmore River Ranch	Location: Hays County, Texas	Drilled by: Davenport Drilling and Pump Service	Construction Date: 2/25/2013
Elevation: 936 ft. MSL	Total Depth: 800 ft.	Latitude: 29* 58' 12.99" N	Longitude: 98* 2' 2.99" W

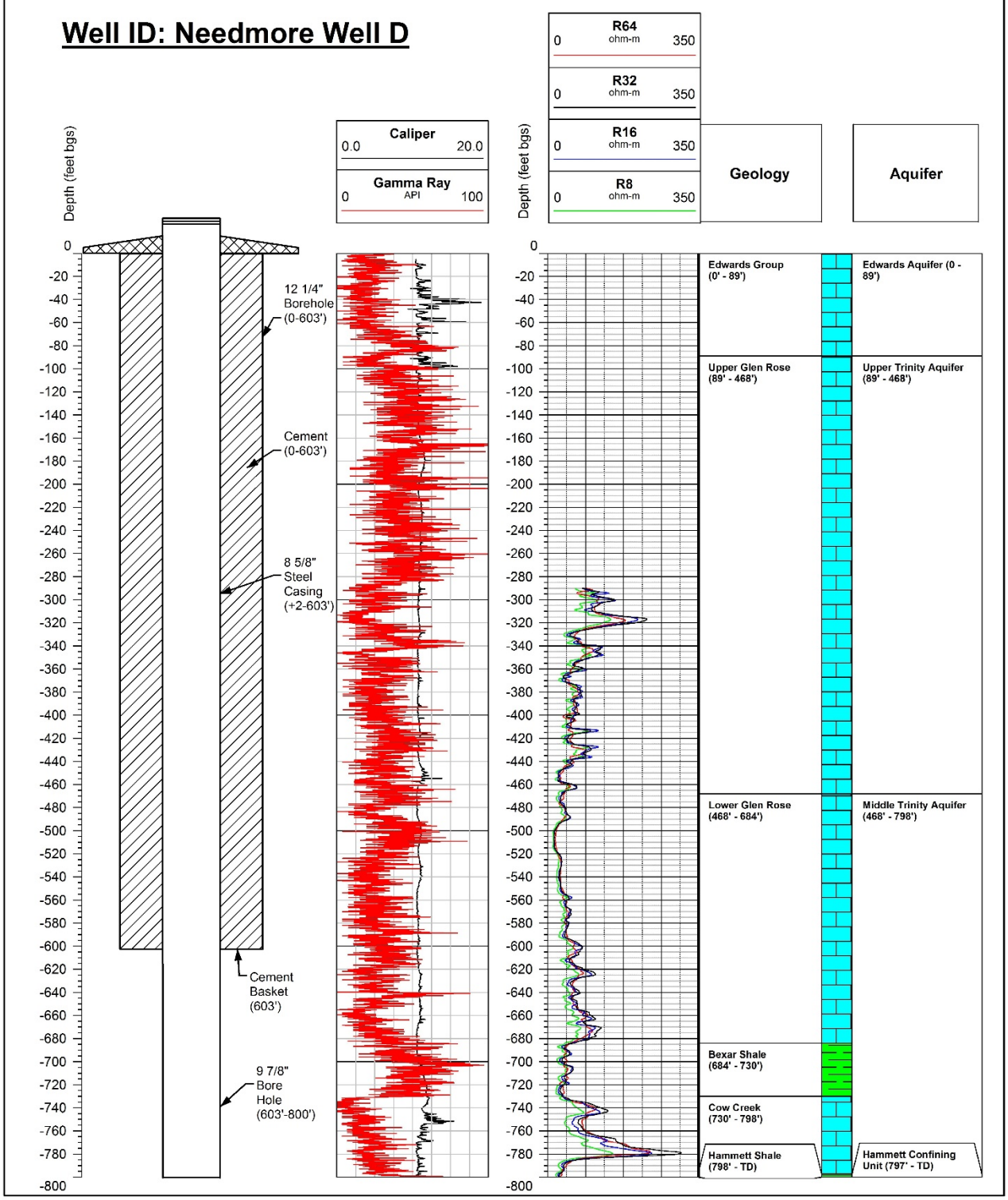


Figure 6: Well log profile

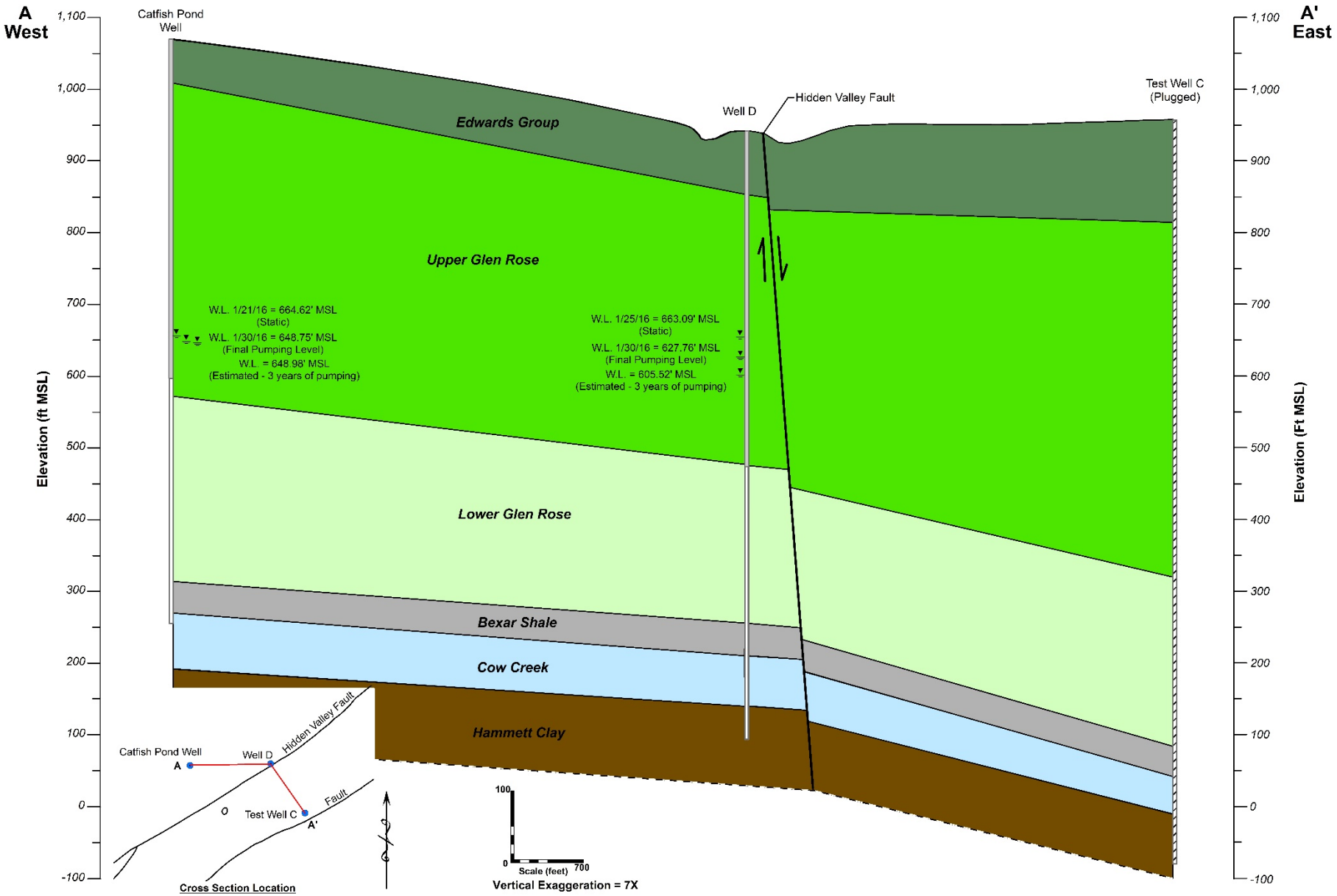


Figure 7: Conceptual hydrogeologic cross section A-A'

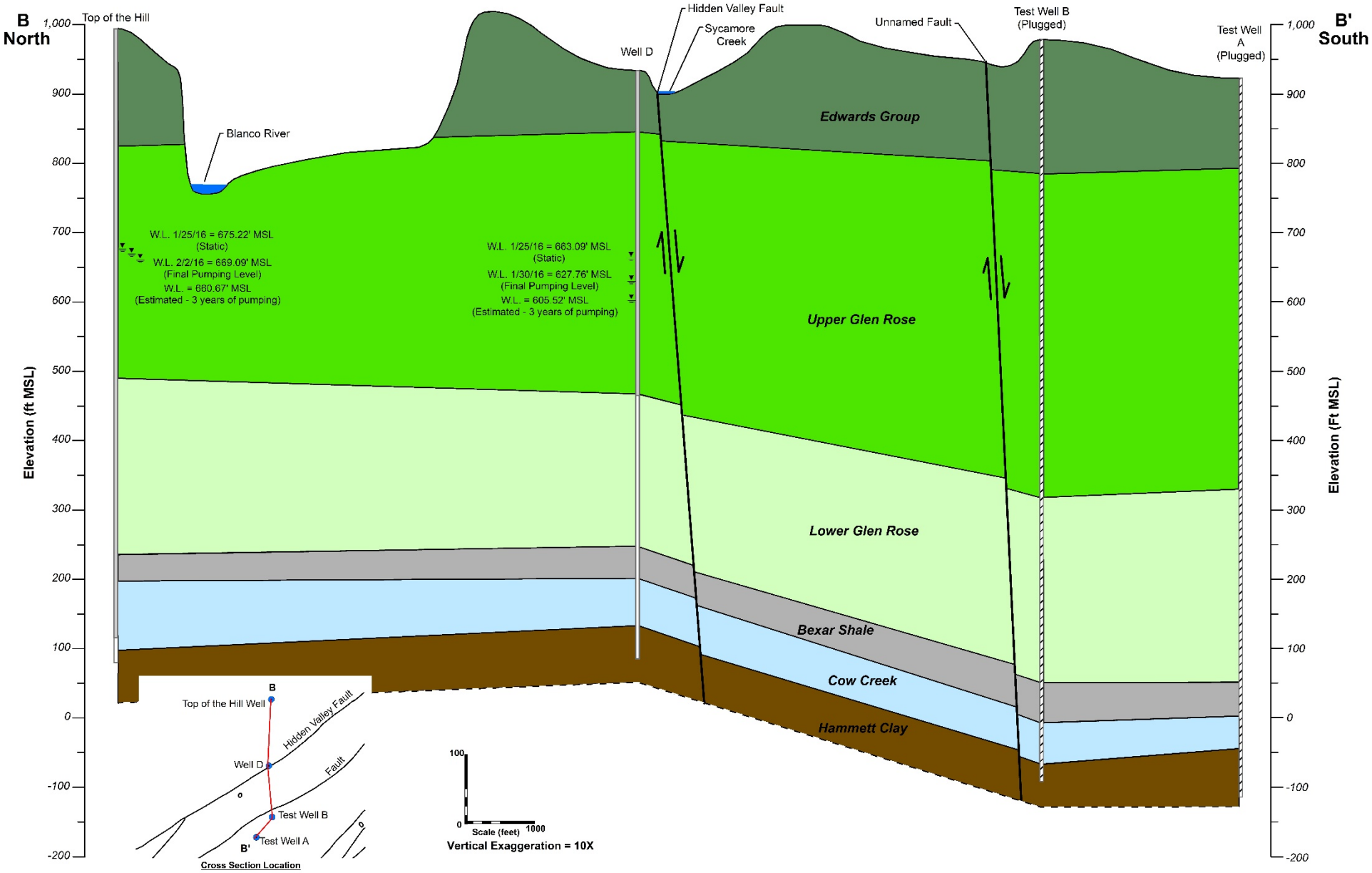


Figure 8: Hydrogeologic cross section B-B'

Section V: Hydrogeology of the Study Area

The Trinity Aquifer in the Hill Country area spans as far north as Gillespie County and as far south as Bexar, Comal, and Hays County where fresh water can be produced. As the name suggests, the Trinity Aquifer is composed of three distinct aquifers: the Upper, Middle and Lower Trinity Aquifers. Figure 9 shows the location of the Trinity Aquifer with respect to other major aquifers in the area, including the Edwards Aquifer. The solid green portion of Figure 9 reflects the unconfined zone of the Trinity Aquifer where recharge occurs. The green diagonal hatched region reflects the confined zone of the aquifer where the formations that make up the Trinity Aquifer are located beneath the ground surface. At the Well D site, the Edwards Aquifer is unconfined (recharge zone) and the Trinity Aquifer is under confined conditions.

Typically, the highest yielding portion of the Trinity Aquifer is the Middle Trinity, specifically the Cow Creek Limestone Member of the Travis Peak Formation. This formation is, in some localities, a heavily fractured limestone, making it more productive because of its enhanced ability to transmit groundwater. At the Needmore Ranch Well D site, the major producing zone is the Cow Creek Limestone. Production estimates were made during drilling [in 2012], and it was estimated that the Edwards Group produced negligible amounts of water, the Upper and Lower Glen Rose Limestones produced small amounts (<10 gpm), and the Cow Creek Limestone yielded more than 500 gpm.

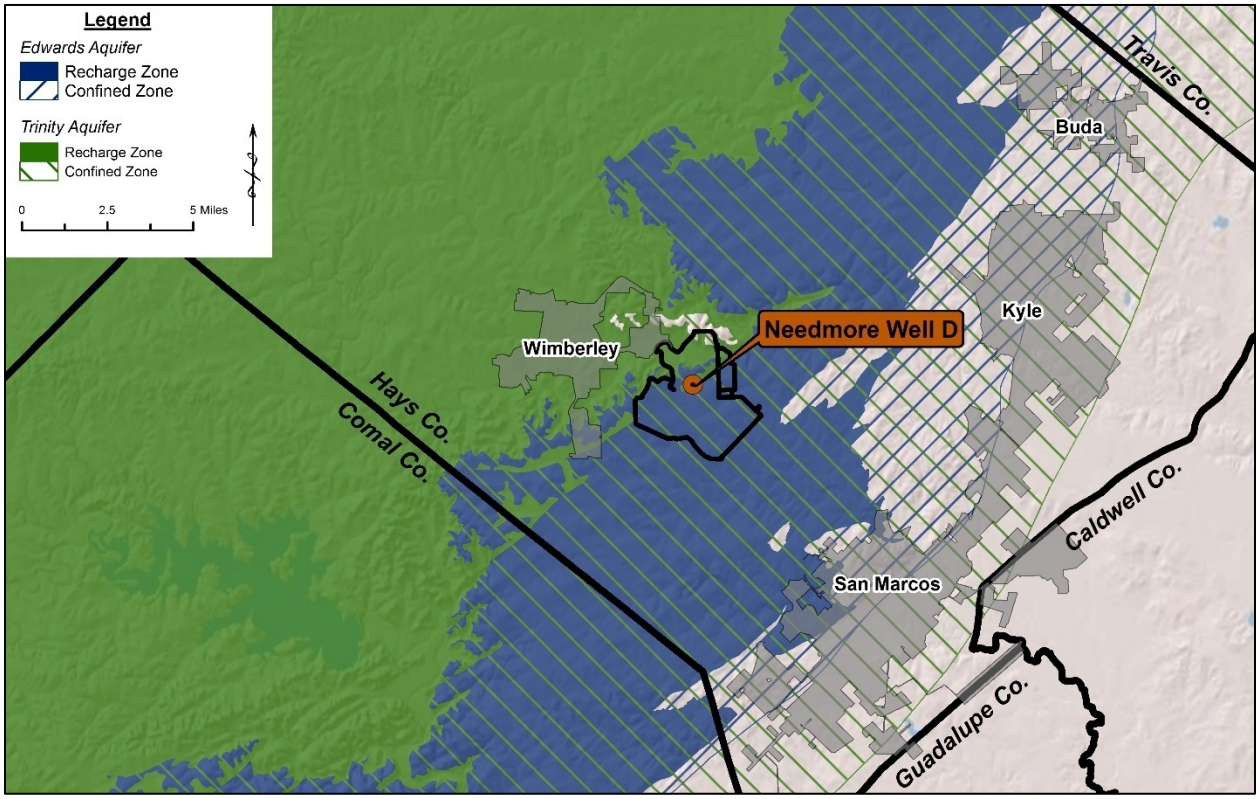


Figure 9: Aquifer map

Figure 10 provides a map with hydrographs from three Middle Trinity Aquifer (Cow Creek Member) wells located in Hays County which are a part of the Texas Water Development Board (TWDB) statewide monitoring system. Each hydrograph shows the water level from the well accompanied by rain gauge data from a nearby Edwards Aquifer Authority (EAA) rain gauge HA157. Groundwater in the Middle Trinity Aquifer generally flows in a southeast direction. Overall, the hydrographs show relatively long term stable water level elevations with fluctuations in the short term. The hydrographs also show the rapid response to precipitation and thereby recharge to the aquifer.

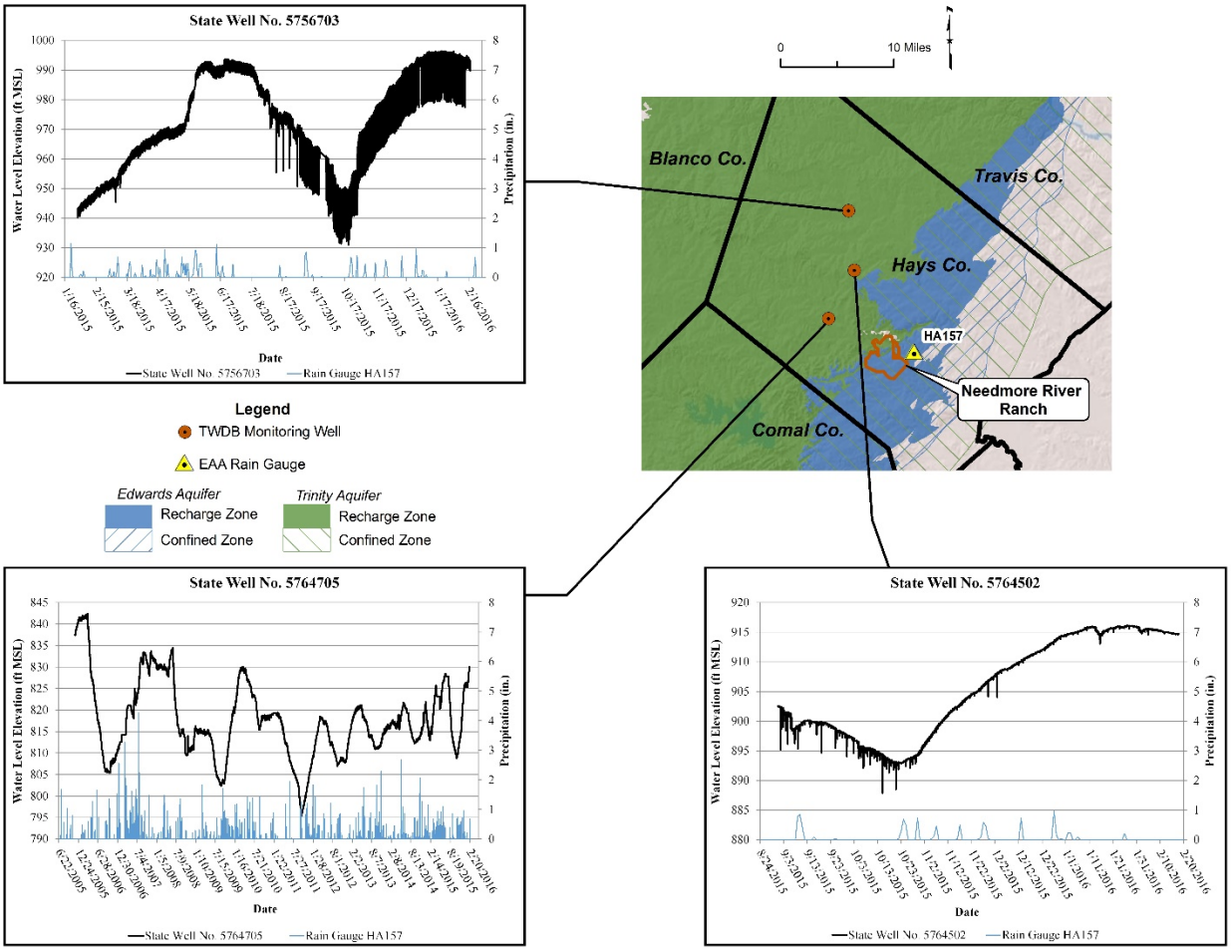


Figure 10: Hydrographs of Hays County Cow Creek Wells

Water levels within the Middle Trinity Aquifer follow a short term cycle of decreasing water level during times of low precipitation and higher well production followed by a recovery of water level during precipitation events. This cyclic pattern can be seen in all of the monitoring wells. Overall, the long term trend of water levels within the three identified monitoring wells show a relatively stable level maintained. The observation wells are located within the Trinity Aquifer recharge zone which results in greater water level fluctuations, over the short term due to a more direct effect of precipitation events and groundwater migrating towards the confined zone. It is common for the recharge zone of aquifers to

experience greater water level fluctuations while water levels within the confined zone are generally more stable. The hydrograph for State Well No. 5764705 has the longest period of record, and demonstrates the short term fluctuations with stability over the long term. All of the hydrographs show a recent trend of water level rise since the Fall of 2015.

Section VI: Inventory of Potential Recharge and Discharge Features

In the vicinity of Well D, wells are completed within the Upper Trinity or the Middle Trinity Aquifers. A well site investigation conducted on January 28, 2016 indicated that no known recharge features or springs that affect the Middle Trinity Aquifer are located within a one mile radius of Well D. Due to Well D being downdip within the confined portion of the Trinity Aquifer, it is expected that no naturally occurring recharge or discharge features for the Middle Trinity Aquifer would be encountered within a mile of Well D.

Figure 11 provides a map of the wells, surface water bodies, springs, karst features, and potential recharge features in the area surrounding Well D. There are no nearby springs or potential recharge features impacting the well. There are four existing wells within a mile radius of Well D, the Caboose Well, Main House Well, Pavilion-Pens Well, and the Boys House Well. No data or well reports were located for Main House Well or the Pavilion-Pens Well, therefore the completion depth is unknown. The Caboose Well is completed within the Upper Trinity Aquifer and was utilized as a monitoring well during the aquifer test. The Boys House well is most likely completed within the Upper and Lower Glen Rose Formations. Appendix E provides the available well reports for all of the wells on the Needmore property.

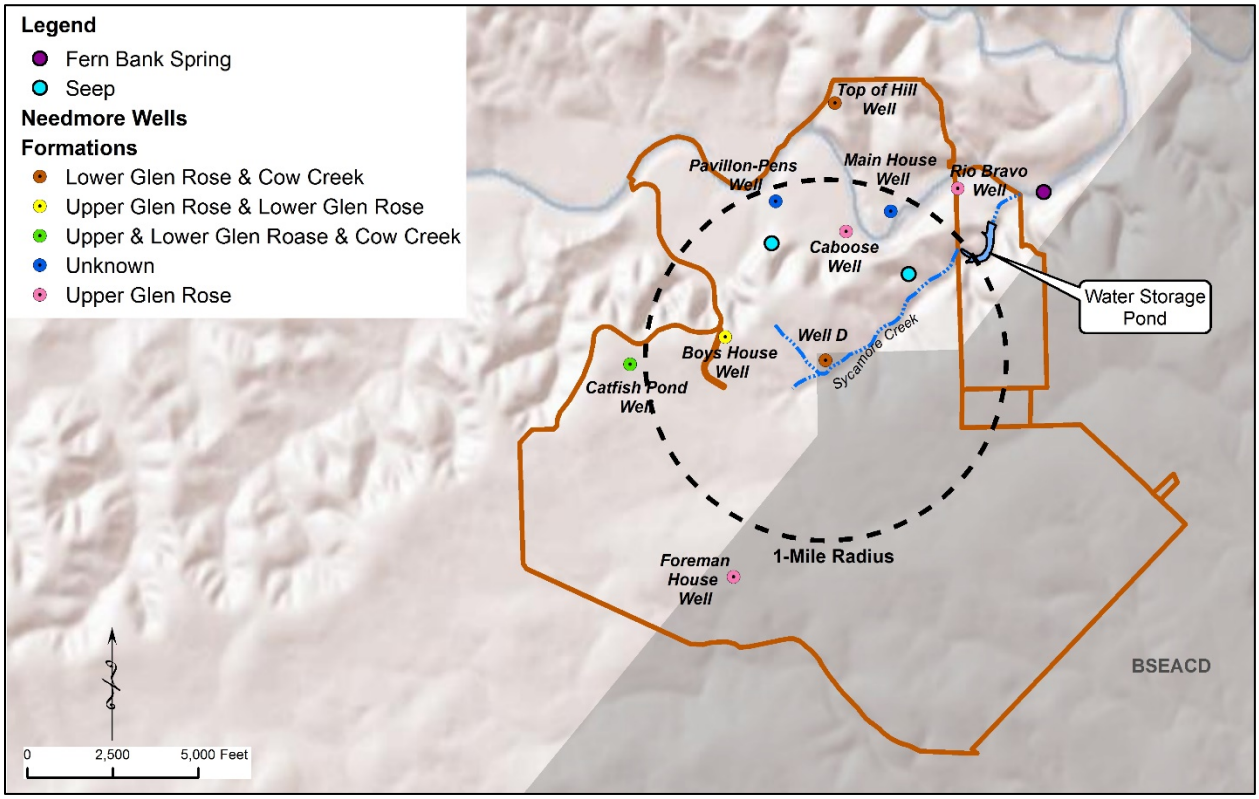


Figure 11: Map of area wells and surface water bodies near Well D

The Blanco River is the only major surface water body located near Well D; Sycamore Creek and the Water Storage Pond on the creek are considered minor surface water bodies (Figure 11). Neither surface water body directly influences Well D. While there are karst features such as fractures and faults present within the project site, the production zone of the Cow Creek Member is present at over 700 ft. below ground surface (ft. bgs). The depth of the Cow Creek Member does not lend itself to a direct connection to any surface features in the immediate vicinity of Well D that would impact water levels or recharge. Fault trends and surface geology are provided in Figure 5. Two minor seeps were noted during the field investigation and most likely issue from the thin layer of Edwards Formation in the area of Well D (Figure 9). Fern Bank Springs is located outside of the 1-mile investigation area to the northeast of Needmore. Fern Bank Springs is a documented Edwards Aquifer Spring (RECON, et al, 2012) and is not connected to the Middle Trinity Aquifer or impacted by Well D.

Section VII: Well Drilling, Aquifer Testing, and Water Quality Analysis

VII.1. Introduction

Needmore completed construction on Well D in 2013 with plans of utilizing the well for livestock, wildlife watering and irrigation purposes throughout the ranch property. Since that time, the portion of the property where Well D is located has been annexed into the BSEACD jurisdiction. As a result, an aquifer test was conducted at Well D to fulfill the Hydrogeologic Report requirements for a regular production permit mandated by BSEACD. A five day aquifer test (120 hours) was completed utilizing Well D as the pumping well, and the Top of the Hill Well (Needmore), the Catfish Pond Well (Needmore), Caboose Well (Needmore), and the Amos Well (off-site) serving as observation wells. Figure 12 provides a location map of the pumping well and the observation wells.

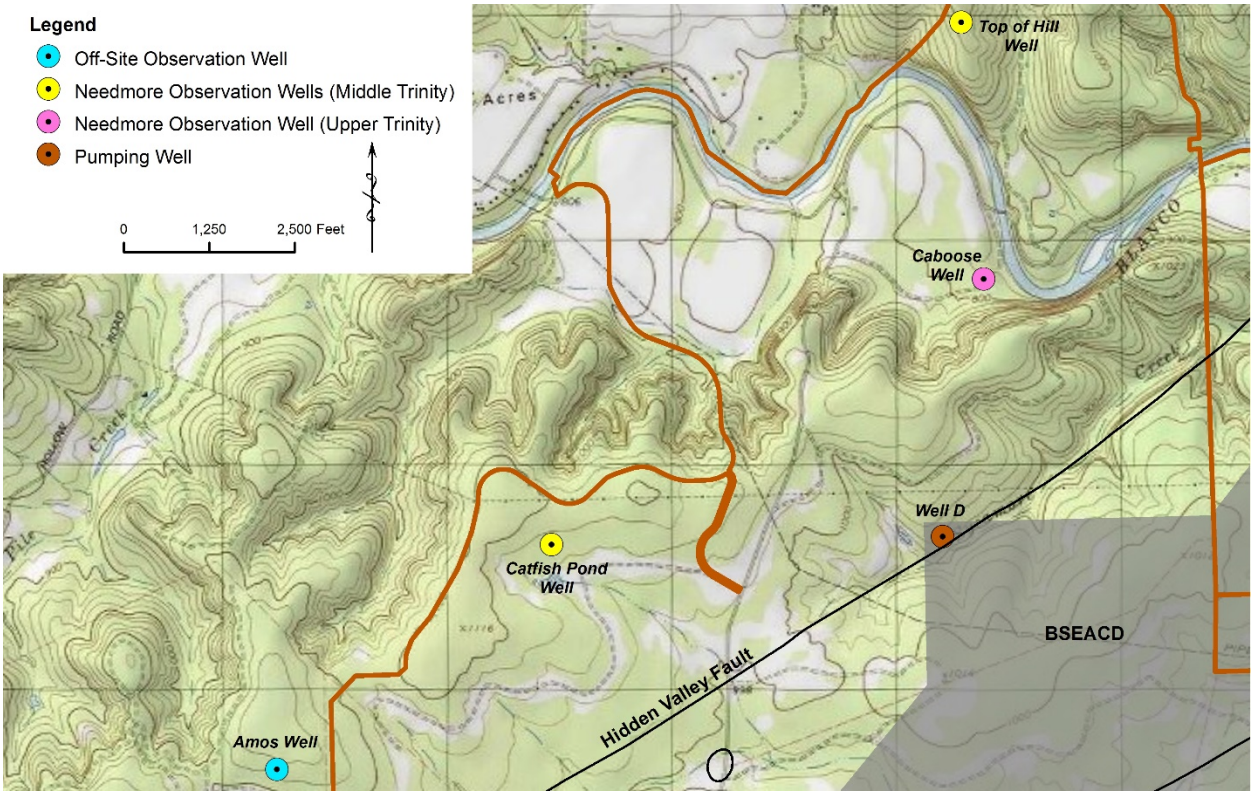


Figure 12: Location map - pumping well and observation wells

VII.2. Well Construction

Well D

Davenport Drilling and Pump Service (Davenport Drilling) originally drilled Well D in the Fall of 2012 and completed the well in February of 2013. According to the State of Texas Well Report, Well D was constructed with 8-inch PVC cemented within a 12 ¼-inch borehole to 460 ft. bgs and an open hole completion from 460 to 800 ft. bgs (Appendix E). According to Needmore staff, in 2015 the well casing was damaged requiring repair. The well repairs were approved and overseen by BSEACD in the Fall of 2015. BSEACD required a deeper casing setting to seal off possible anhydrite beds within the Lower

Glen Rose Formation and a larger diameter annulus in the cased portion of the well. According to the amended State of Texas Well Report, as mandated by the BSEACD, Well D is now constructed with 8 5/8-inch steel casing cemented within a 12 ¾-inch borehole to 603 ft. bgs and an open hole completion from 603 to 800 ft. bgs. A geophysical log was conducted during the original well construction; based on the analysis of the geophysical log, the Edwards Group is present from ground surface to 89 ft. bgs, the Upper Glen Rose Formation is present from 89 to 468 ft. bgs, the Lower Glen Rose Formation is present from 468 to 684 ft. bgs, the Bexar Shale is present from 684 to 730 ft. bgs, the Cow Creek Member is present from 730 to 798 ft. bgs, and the Hammett Clay is present from 798 ft. bgs to the total depth (Appendix E). Table 3 provides a well construction summary and Figure 13 provides a well construction profile. In addition to the well repair, the BSEACD required a downhole video survey be run prior to and after well repair, an additional caliper log and a cement bond log.

Top of the Hill Well

Based upon records obtained after Needmore River Ranch was acquired in 20[11 or 13 – Needmore Ranch II LTD purchased in 2011 then transferred to Needmore River Ranch, LLC in 2013], the Top of the Hill Well was drilled by Kutscher Drilling in December 2005. According to the State of Texas Well Report, the well was constructed with a 5-inch PVC casing cemented within a 8-inch borehole to 700 ft. bgs and an open hole completion from 700 to 1,100 ft. bgs (Appendix E). However, a geophysical log was conducted on October 17, 2012, which showed the 5-inch PVC casing from +2 ft. to 878 ft. bgs and a total depth of 915 ft. bgs (Appendix D). Based on the analysis of the geophysical log, the Edwards Group is present from ground surface to 168 ft. bgs, the Upper Glen Rose Formation is present from 168 to 503 ft. bgs, the Lower Glen Rose Formation is present from 503 to 759 ft. bgs, the Bexar Shale is present from 759 to 796 ft. bgs, the Cow Creek Member is present from 796 to 895 ft. bgs, and the Hammett Clay is present from 895 ft. bgs to the total depth (Appendix D). The lower section of the Top of the Hill Well (915 to 1,100 ft. bgs) most likely filled in due to the Hammett Clay sloughing off and sealing off any formations below 915 ft. bgs. Table 3 provides a well construction summary and Figure 13 provides a well construction profile.

Catfish Pond Well

The Catfish Pond Well was drilled on an unknown date and no well reports were located for the well. A geophysical log was conducted on October 17, 2012, which showed 6-inch steel casing from +1.5 ft. to 475 ft. bgs and an open hole completion from 475 to 810 ft. bgs. Based on the analysis of the geophysical log, the Edwards Group is present from ground surface to 61 ft. bgs, the Upper Glen Rose Formation is present from 61 to 542 ft. bgs, the Lower Glen Rose Formation is present from 497 to 756 ft. bgs, the Bexar Shale is present from 756 to 800 ft. bgs, and the Cow Creek Member is present from 800 to the total depth (Appendix D). Table 3 provides a well construction summary and Figure 13 provides a well construction profile.

Amos Well

The Amos Well was drilled on an unknown date and no well reports were located for the well. However, a geophysical log was conducted on December 3, 2015, which showed a total depth of 868 ft. bgs. No caliper log was run, therefore the casing depth was not able to be determined. Based on the analysis of the geophysical log, the Edwards Group is present from ground surface to 38 ft. bgs, the Upper Glen Rose Formation is present from 38 to 572 ft. bgs, the Lower Glen Rose Formation is present from 572 to 774 ft. bgs, the Bexar Shale is present from 774 to 823 ft. bgs, and the Cow Creek Member is

present from 823 to the total depth (Appendix D). Table 3 provides a well construction summary and Figure 13 provides a well construction profile.

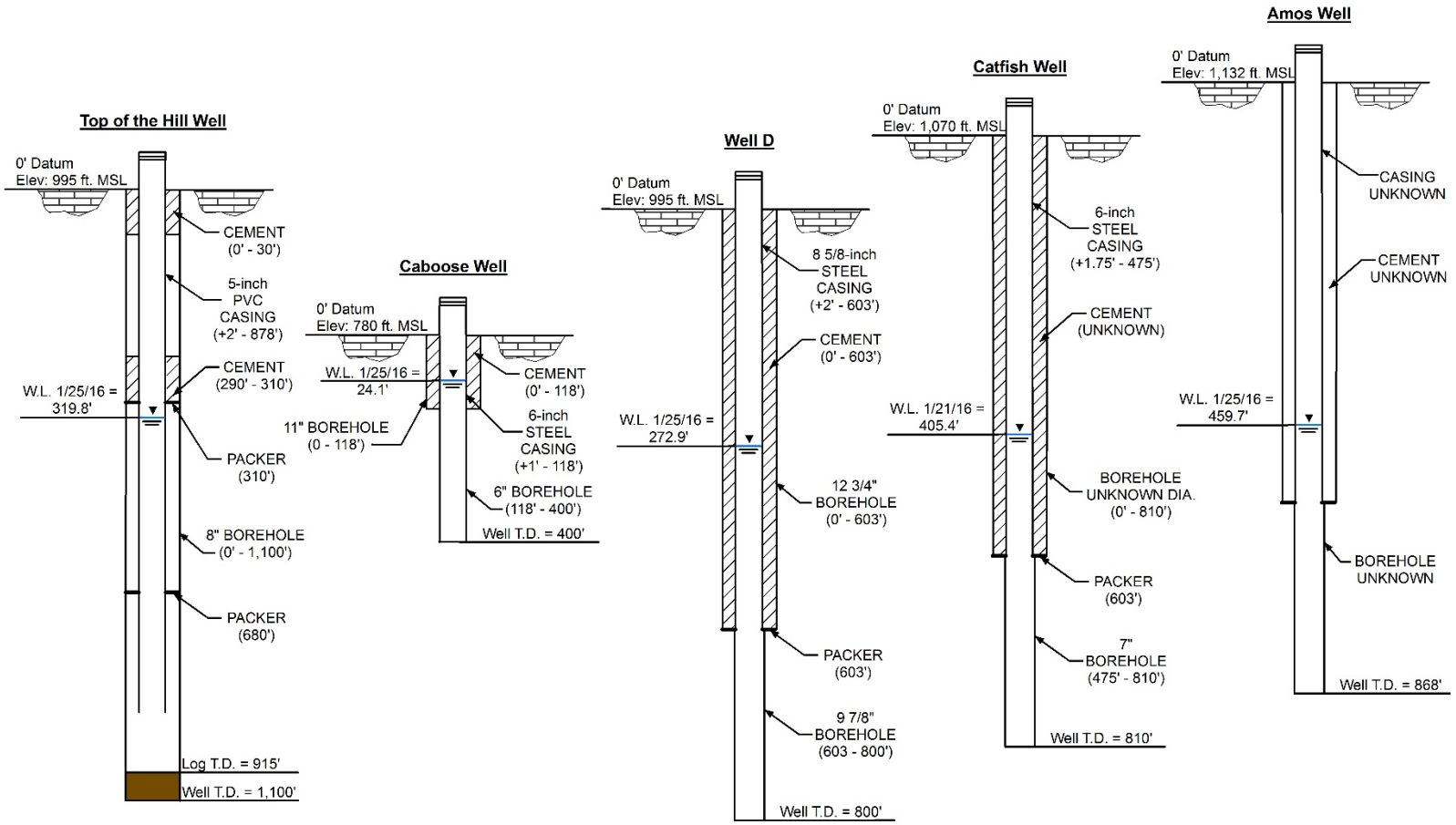
Caboose Well

The Caboose Well was drilled by Jolander Well Drilling in April 2001. According to the TDLR Well Report, the well was constructed with 6-inch steel casing cemented within a 11-inch borehole to 118 ft. bgs and an open hole completion of 6-inches from 118 to 400 ft. bgs (Appendix E). Based on the location and depth of the well, the production zone of the well is within the Upper Trinity Aquifer. The well was monitored to observe if there was any connection between the Upper Trinity Aquifer and the Middle Trinity Aquifer. Table 3 provides a well construction summary and Figure 13 provides a well construction profile.

Table 3: Summary of well construction details

Well	Completion Date	Elevation (ft. MSL)	Hole Diameter (in.)	From (ft.bgs)	To (ft.bgs)	Casing Type	Casing Size (in.)	From (ft.bgs)	To (ft.bgs)	Test Pump	Static Water Level (ft. MSL)
Well D	1/1/2016	936	12 3/4	0	603	Steel	8 5/8	+2	603	60 HP set on 588 ft. of 5" gal. stl.	663.09 (1/25/16)
			9 7/8	603	800	Open Hole	9 7/8	603	800		
Top of the Hill Well	12/12/2005	995	8	0	1,100	PVC	5	+2	878	-	675.22 (1/25/16)
			-	-	-	Open Hole	8	878	1,100		
Catfish Pond Well	-	1,070	-	-	-	Steel	6	+1.5	475	-	664.62 (1/21/16)
			7	475	810	Open Hole	7	475	810		
Amos Well*	-	1,132	-	-	-	-	-	-	-	-	672.3 (1/25/16)
			-	-	-	-	-	-	-		
Caboose Well	4/25/2001	780	11	0	118	Steel	6	+1	118	-	755.9 (1/25/16)
			6	118	400	Open Hole	6	118	400		

Notes: ft. = feet; in. = inches; MSL = Mean Sea Level; HP = horsepower; bgs = below ground surface; * - no completion data available



Notes:

1. Top of the Hill Well profile created from State of Texas Well Report No. 148941 and geophysical log conducted on 10-17-2012.
2. Caboose Well profile created from TDLR Report submitted by Jolander Well Drilling on 4/25/01.
3. Well D profile created from State of Texas Well Report No. 317171.
4. Catfish Well profile created from geophysical log conducted on 10-17-2012.
5. Amos Well profile created from geophysical log conducted on 12-3-2015.
6. Figure for schematic purposes; not drawn to scale.

Figure 13: Aquifer test well profiles

VII.3. Aquifer Testing

Aquifer tests allow for the estimation of transmissivity, hydraulic conductivity, specific capacity, and storativity of the well when an observation well is available. In cooperation with the BSEACD, the following actions were taken to ensure an acceptable aquifer test:

- At Well D, beginning on January 20, 2016, background water levels were taken (i) for approximately five days prior to the pumping phase of the test, (ii) during the pumping phase of the test, and (iii) for nine days after the pumping phase of the test using a pressure transducer (In-Situ Level Troll 500 accurate to the nearest 0.01 ft.). A final water level measurement was taken manually with an e-line on February 16, 2016;

- At the Top of the Hill Well, beginning on January 21, 2016, background water levels were taken (i) for approximately four days prior to the pumping phase of the test, (ii) during the pumping phase of the test, and (iii) for nine days after the pumping phase of the test using a pressure transducer (In-Situ Level Troll 400 accurate to the nearest 0.01 ft.). A final water level measurement was taken manually with an e-line on February 16, 2016;

- At the Catfish Pond Well, beginning on January 21, 2016, a static water level was taken approximately four days prior to the pumping phase of the test. A pressure transducer (In-Situ Level Troll 400 accurate to the nearest 0.01 ft.) was set within the well approximately one day after the pumping phase of the test began on January 26, 2016, and remained within the well for nine days after the pumping phase of the test. A final water level measurement was taken manually with an e-line on February 16, 2016;

- At the Amos Well, beginning on January 7, 2016, background water levels were taken for approximately eighteen days prior to the pumping phase of the test, during the pumping phase of the test, and for twelve days after the pumping phase of the test using a pressure transducer (In-Situ Level Troll 400 accurate to the nearest 0.01 ft.). The transducer was installed by HTGCD staff and monitored by HTGCD and BSEACD staff prior, during, and after the Well D aquifer test;

- The flow meter used to measure discharge from Well D was calibrated and tested prior to the aquifer test (Appendix F);

- Based on discussions with BSEACD staff, notification to surrounding well owners was not necessary prior to commencement of the aquifer test due to the distance from Well D to the property boundary. Well D is located within the central portion of the property more than one half-mile from the closet property boundary;

- A total of 3,939,470 gallons was pumped during the 120-hour aquifer test. This volume represented almost five times the requested daily volume of 792,000 gallons. The BSEACD requires the aquifer test to produce at least three times the requested daily volume;

- Discharge from Well D was routed away from the well site ensuring no recharge to the pumping well;

- A 90% recovery of water levels was confirmed; and

- Pumping of Needmore Wells other than Well D was minimized during the aquifer test to reduce interference and effects on water levels. The only known pumping that occurred

during the pumping phase of the aquifer test from within the Needmore boundary was from the Foreman's House Well (Upper Trinity Aquifer – Figure 11) on Tuesday January 25, 2016 from 7 AM to 12 PM, Wednesday January 27, 2016 from 2 PM to 4 PM, and on Friday January 29, 2016 from 3 PM to 5 PM. The total pumped volume from the Foreman's House Well was estimated by Needmore Staff to be 5,500 gallons.

On January 19, 2016, Davenport Drilling set a test pump (Grundfos 475S600-7 pump with a 60 horsepower motor) within Well D on 588 ft. of 5-inch galvanized steel column pipe. The pump (Grundfos 475S600-7) used in the aquifer test is the same model pump described in the construction documents provided to the BSEACD (Appendix G – letter dated 10-9-2015) as the largest pump that could fit within the well and used to determine the Maximum Production Capacity for the temporary production permit under HB 3405. A pressure transducer capable of measuring the water level and temperature at one minute intervals was placed within the well by Wet Rock Groundwater Services, LLC (Wet Rock) on January 20, 2016. At that time, a static water level in Well D was measured at 274.54 ft. bgs, and the test pump was turned on for approximately one hour to confirm pumping rates (Figure 14 – Appendix H). On January 25, 2016, a static water level was measured at 272.9 ft. bgs, resulting in a 1.64 ft. increase in water level in Well D prior to the start of the aquifer test (Figure 14 – Appendix H).

On January 21, 2016, a pressure transducer capable of measuring the water level and temperature at one minute intervals was placed within the Top of the Hill Well (observation well) by Wet Rock and BSEACD staff. At that time, a static water level was measured at 319.64 ft. bgs (Figure 14 – Appendix H). Prior to starting the pumping phase on January 25, 2016, a static water level was measured at 319.78 ft. bgs resulting in a 0.14 ft. decrease in water level (Figure 14 – Appendix H). The power was disabled to the Top of the Hill Well during the aquifer test to ensure no pumping from the well occurred during the aquifer test.

On January 26, 2016, a pressure transducer capable of measuring the water level and temperature at one minute intervals was placed within the Catfish Pond Well (observation well) by Wet Rock. At that time, the water level was measured at 409.17 ft. bgs (Figure 14 – Appendix H). Prior to starting the pumping phase, a static water level of 405.38 ft. bgs was measured by Wet Rock and BSEACD Staff at the Catfish Pond Well on January 21, 2016. A decrease of 3.79 ft. bgs was observed between the time the static water level was measured and when the transducer was placed within the well (Figure 14 – Appendix H). The transducer was placed in the Catfish Pond Well after the pump test started due to issues with fitting the transducer in the dedicated 1-inch PVC water level measuring assembly. The power was disabled to the well during the aquifer test to ensure no pumping from the well occurred during the aquifer test.

On January 7, 2016, a pressure transducer capable of measuring the water level and temperature at ten minute intervals was placed within the Amos Well (observation well) by Hays Trinity Groundwater Conservation District (HTGCD) staff. At that time, a static water level was measured at 458.5 ft. bgs. (Figure 14 – Appendix H). Prior to starting the pumping phase on January 25, 2016, a static water level was measured at 459.7 ft. bgs resulting in a 1.2 ft. decrease in water level in the Amos Well. (Figure 14 – Appendix H). The Amos Well is an active domestic well, and appears to have been producing at various times during the monitoring period, no pumping intervals or volumes were provided by HTGCD or BSEACD.

Manual water levels were taken at the Caboose Well (Upper Trinity Aquifer) with an e-line on several occasions prior to the aquifer test, during the test, and after the test to measure any effects of pumping between the Middle Trinity Aquifer and the Upper Trinity Aquifer. Prior to the pumping phase of the test on January 25, 2016, the static water level was 24.1 ft. bgs in the Caboose Well. (Table 5). The power was disabled to the well during the aquifer test to ensure no pumping from the well occurred during the aquifer test.

At 10:20 on January 25, 2016, the pump was turned on the Well D and ran for 120.7 hours at an average rate of 544 gpm. Appendix H provides the aquifer test analyses and data; Figure14 provides a graph of the water levels at the pumping well (Well D) and the observation wells during the aquifer test. Figure 15 provides a hydrograph of the water levels at Well D and precipitation from a nearby EAA rain gauge HA157. A minor precipitation event (0.21 inches) was recorded on January 26, 2016, at HA157, however, no recharge effects were observed. The final production rate was 544 gpm with 35.3 feet of drawdown in Well D for a specific capacity of 15.4 gpm/ft. The pumping level drew down Well D approximately 30.6 ft. over the first 3 days of the test, 3.18 ft. over the fourth day of the test, and only 1.5 ft. over the final 24 hours of the test. The maximum drawdown recorded at the observation wells was 14.2 ft. (Jan. 30, 2016, at 16:20) at the Amos Well, 15.87 ft. (Jan. 30, 2016, at 14:25) at the Catfish Well, 6.13 ft. (Feb. 2, 2016, at 20:17) at the Top of the Hill Well, and zero effective drawdown at the Caboose Well. When the Well D pump was shut off, the water level initially rose rapidly to 296.4 ft. bgs in the first 30 minutes. Recovery then slowed, and the water level achieved 90% recovery in Well D approximately two weeks after pumping stopped (Figure 15 – Appendix H).

In theory the water level should recover at the same rate the water level drew down during the recovery phase. In reality, however, the rate to achieve 90% recovery typically takes longer. Driscoll points out that *"drawdown and recovery should be identical if the aquifer conditions conform to the basic assumptions of the Theis concept (Driscoll, 1986)."* Karst aquifers like the Middle Trinity do not conform to the basic Theis assumptions due to the natural heterogeneity and anisotropic properties that occur in fractured limestone aquifers. *"Complete recovery generally requires a period considerably longer than the previous pumping period, except in cases where recharge to the aquifer occurs during the pumping and recovery periods. The storativity for a confined aquifer depends upon the elastic properties of the formation. If the aquifer is not perfectly elastic, it does not rebound vertically during recovery of water levels (recovery of pressure) at the same rate that it is compressed as a result of the drawdown during the preceding pumping (Driscoll, 1986)."* The heterogeneity, anisotropy, and non-perfect elasticity characteristics of the Middle Trinity Aquifer explain the delayed recovery rates post pumping phase of the aquifer test.

Due to the scale used in Figures 14 and 15, it may appear that the water level in Well D is continuing its rate of drawdown throughout the pumping phase of the aquifer test. The scaling issue in Figures 14 and 15, whereby the horizontal axis (date and time) covers a long period of time versus the vertical axis (water level) representing a small change in value, has caused the water level graphs to be distorted. When analyzing the data with greater accuracy during the pumping phase, it is clear that Well D had reached a steady state, or quasi-steady state, near the end of the pumping phase. Figure 16 provides a graph of the rate of change in drawdown (ft./min) during the pumping phase of the aquifer test. The rate of drawdown in Well D decreased with time nearing a change of zero towards the end of the pumping phase. This clearly suggests that Well D had reached a quasi-steady state or equilibrium

during the pumping phase of the aquifer test.

The greatest drawdown in the observation wells was observed at the Amos Well (14.2 ft.) and the Catfish Pond Well (15.87 ft.) while the least observable drawdown was at the Top of the Hill Well (6.13 ft.). This is most likely due to the alignment of the Amos and Catfish Pond Wells with Well D along the Hidden Valley Fault (Figure 12). A greater hydraulic connection between wells in a karst aquifer is typical along the dominant fracture trace; in this case associated with the Balcones Fault Zone along a northeast/southwest trend. Drawdown perpendicular (Top of the Hill Well) to the dominant fracture trace is much less, and forms an elliptical cone of depression. It is also important to note that the Amos Well appears to be producing water at various intervals throughout the monitoring phase and the pumping phase of the aquifer test (Figure 14). In addition, the data also suggests possible interference from other nearby domestic wells. Figure 14 shows sporadic water level decreases and increases in the Amos Well for the duration of the monitoring period. While it is apparent that most of the drawdown in the Amos Well was due to the pumping of Well D, the cumulative effect of pumping in the Amos Well and other domestic wells in the area did have some influence on the drawdown at the Amos Well, and the recovery of the water level within the well.

Throughout the Well D aquifer test, manual water level measurements were taken at the Caboose Well which is completed within the Upper Trinity Aquifer. Table 4 provides a summary of water levels measured at the Caboose Well. There was no indication of drawdown from pumping Well D at the Caboose Well. The lack of drawdown at the Caboose Well indicates a lack of connection between the Middle Trinity and the Upper Trinity Aquifers.

Table 4: Water level measurements at the Caboose Well during aquifer test

Caboose Well			
Date	**Water Level (ft. bgs)**	**Aquifer Test Phase**	**Well Status**
1/20/2016	24.1	Background	No pumping
1/21/2016	24.1	Background	No pumping
1/25/2016	24.1	Pumping Day 1	No pumping
1/26/2016	24.1	Pumping Day 2	No pumping
1/27/2016	24.1	Pumping Day 3	No pumping
1/28/2016	24.1	Pumping Day 4	No pumping
1/29/2016	24.1	Pumping Day 5	No pumping
2/4/2016	24.4	Post Pumping	Active
2/8/2016	24.6	Post Pumping	Active
Notes: ft = feet; bgs = below ground surface			

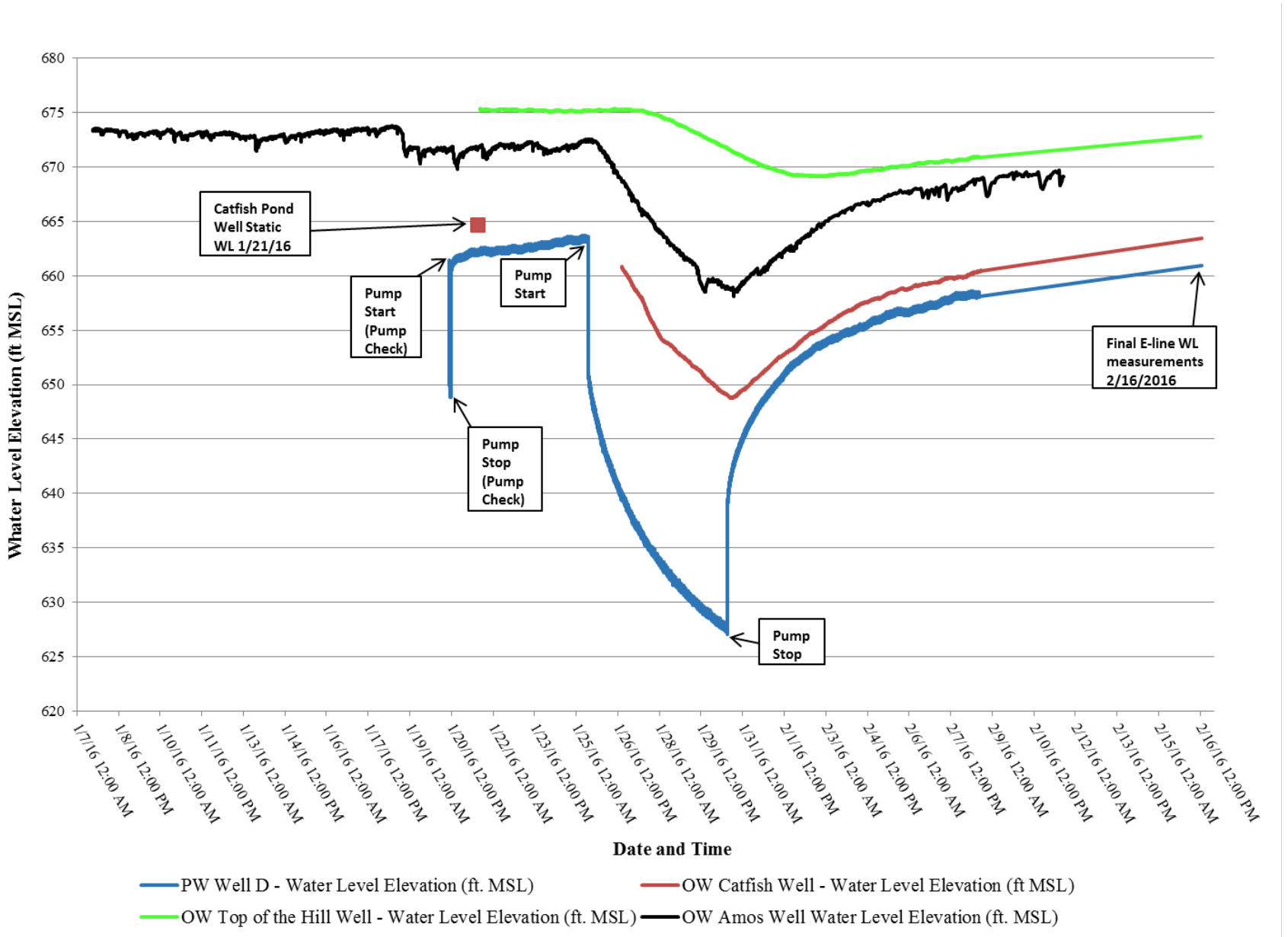


Figure 14: Hydrographs of wells during the aquifer test (1-25-16)

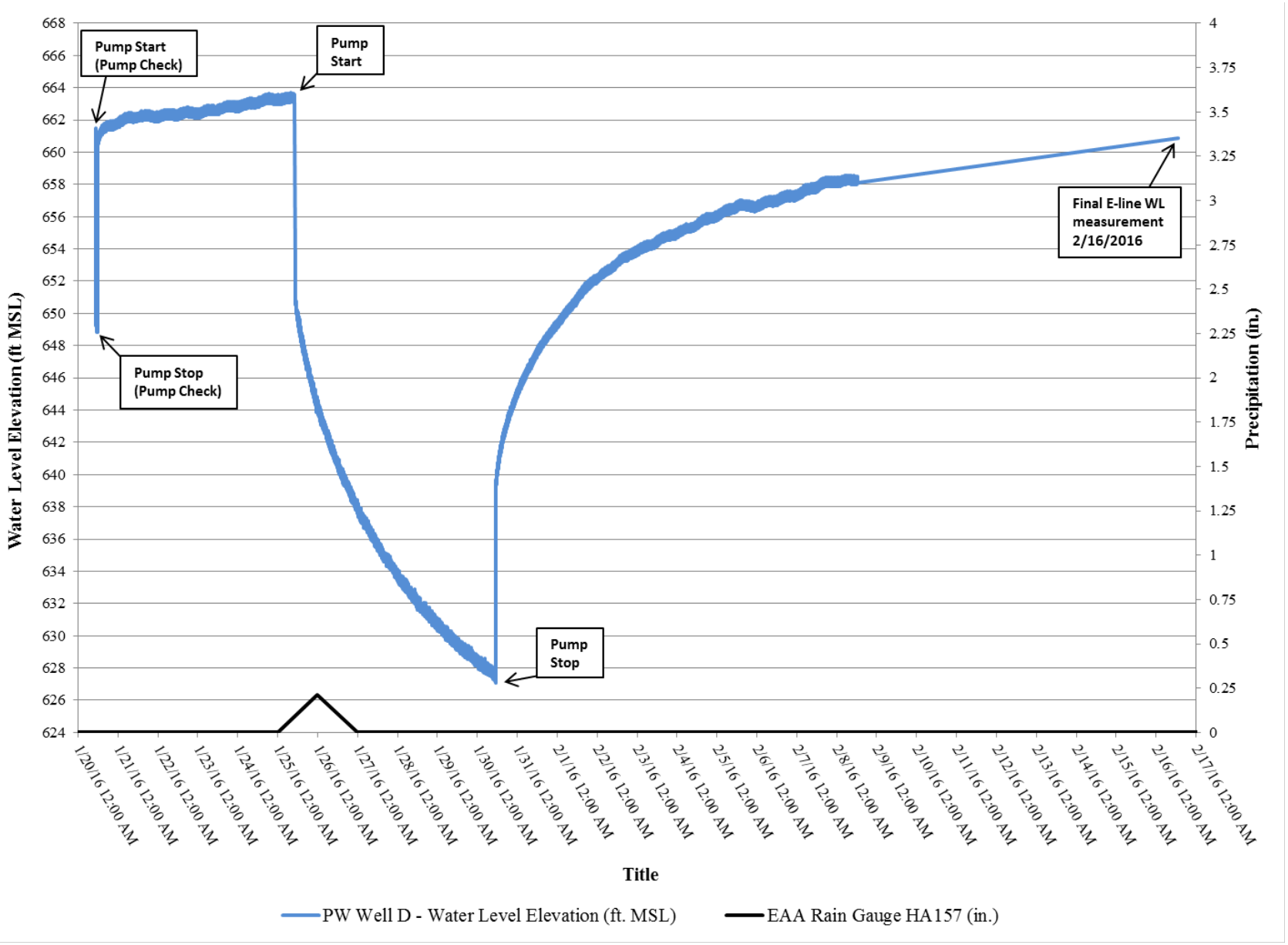


Figure 15: Hydrograph of Well D with precipitation (EAA Rain Gauge HA157) during aquifer test

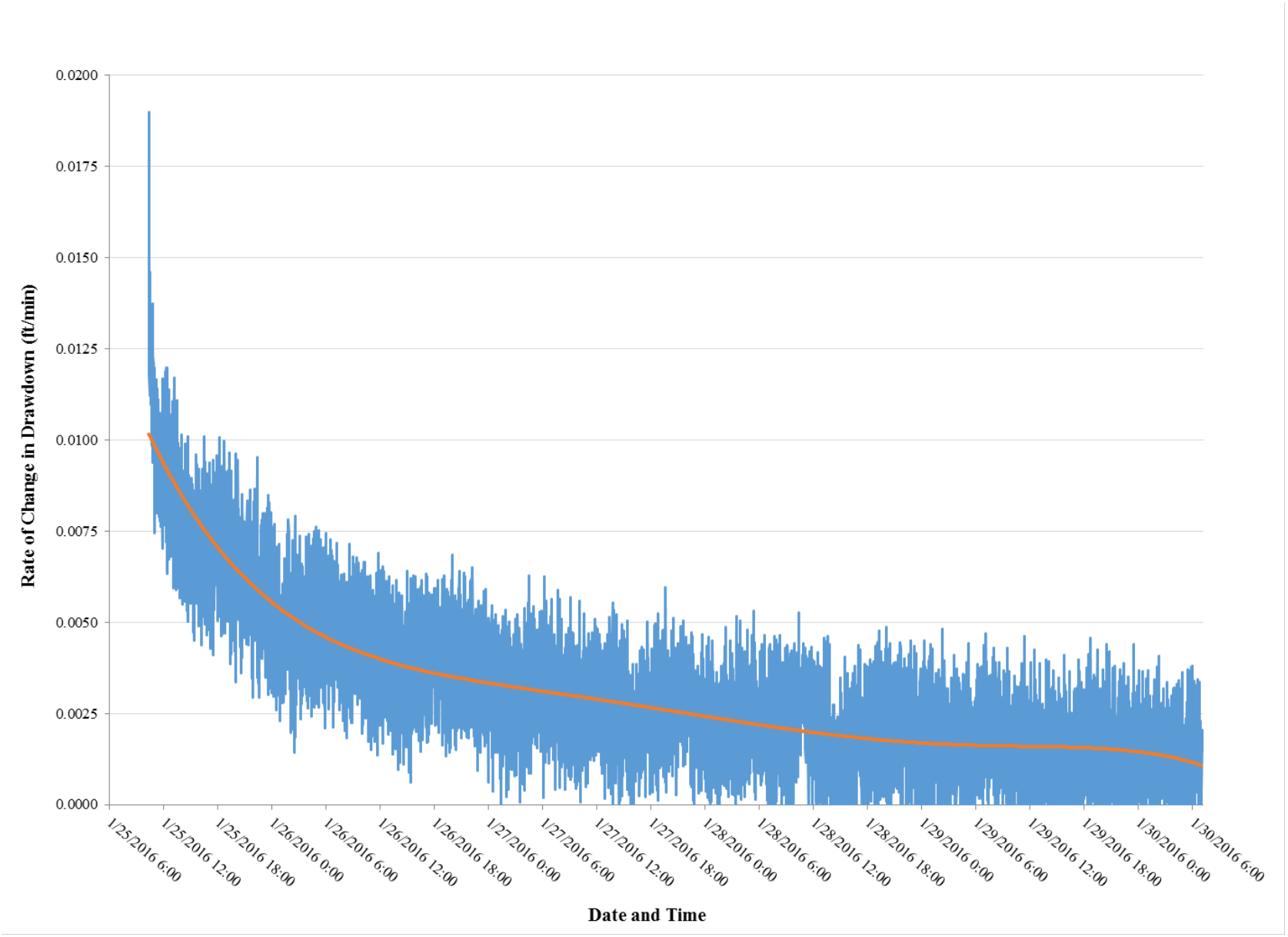


Figure 16: Rate of change in drawdown (ft./min) at Well D during pumping phase - 4-hour rolling average

The Well D aquifer test data was analyzed using the Cooper-Jacob, Theis, and the Theis Recovery methods to calculate transmissivity, hydraulic conductivity, and storativity for the pumping well and observation wells (Appendix H). The following parameters were used to calculate the aquifer test data using the Schlumberger AquiferTest program (Version 2015.1, Build 5.0.1.4), and are summarized in Table 5. The Theis and Cooper-Jacob methods analyze data from the pumping phase and the Theis Recovery method analyzes data from the recovery phase of the aquifer test.

Table 5: Summary of aquifer test parameters

Well ID	Method	Aquifer Thickness (ft.)	Aquifer Penetration	Screen Length (ft.)	Screen Radius (ft.)	Casing Radius (ft.)	Pumping Rate (gpm)
Well D	Cooper-Jacob	330	Partial	194	0.41	0.36	544
	Theis Recovery	330	Partial	194	0.41	0.36	544
	Theis	330	Partial	194	0.41	0.36	544
Top of the Hill Well	Cooper-Jacob	392	Partial	17	0.34	0.21	n/a
	Theis Recovery	392	Partial	17	0.34	0.21	n/a
Catfish Pond Well	Cooper-Jacob	336	Partial	313	0.26	0.25	n/a
	Theis Recovery	336	Partial	313	0.26	0.25	n/a
Amos Well*	Cooper-Jacob	301	Partial	57	0.34	0.21	n/a
	Theis Recovery	301	Partial	57	0.34	0.21	n/a

Notes: Aquifer thickness based on the distance between the top of the Lower Glen Rose Limestone and the bottom of the Cow Creek Limestone (using geophysical logs). *Construction data for Amos Well was estimated from geophysical log.

Using the Cooper-Jacob analysis, the resulting transmissivity at Well D was 4,000 $ft.^2$/day with a hydraulic conductivity of 12.1 ft./day. The Theis analysis resulted in a transmissivity of 4,050 $ft.^2$/day and a hydraulic conductivity of 12.3 ft./day, and the Theis Recovery analysis resulted in a transmissivity of 4,070 $ft.^2$/day and a hydraulic conductivity of 12.3 ft./day (Table 6). To find the storativity, the Cooper-Jacob and Theis methods were used which resulted in an average storativity from the Cooper-Jacob analysis of 1.0×10^{-4} and the Theis analysis of 2.26×10^{-4}. A summary of the aquifer test results are provided in Table 6. During the Well D aquifer test, production was maintained at a steady rate with water levels that remained relatively stable throughout the test. The aquifer test data indicate that at Well D there were no effects from nearby pumping of surrounding wells and no significant recharge or discharge boundaries experienced.

Table 6: Summary of aquifer test results

Method	Date	Well ID	Average Pump Rate (gpm)	Drawdown (ft.)	Transmissivity ($ft.^2/d$)	Hydraulic Conductivity (ft./d)	Storativity
Theis Recovery	1/25/2016	Well D	544	35.3	4,070	12.30	-
		Catfish Well	-	15.87	1,890	5.73	
		Top of the Hill Well	-	6.13	3,310	10.00	
		Amos Well	-	14.2	1,720	5.22	
	Theis Recovery Average				2,750	8.33	
Cooper-Jacob	1/25/2016	Well D	544	35.3	4,000	12.10	-
		Catfish Well	-	15.87	1,250	3.79	6.03 E-5
		Top of the Hill Well	-	6.13	2,550	7.71	2.20 E-4
		Amos Well	-	14.2	2,030	6.14	2.15 E-5
	Cooper & Jacob Average				2,460	7.44	1.0 E-4
Theis	1/25/2016	Well D	544	35.3	4,050	12.30	-
		Catfish Well	-	15.87	1,100	3.30	5.9 E-5
		Top of the Hill Well	-	6.13	2,250	6.82	5.9 E-4
		Amos Well	-	14.2	800	2.42	2.75 E-5
	Theis Average				2,050	6.21	2.26 E-4
Notes: gpm = gallons per minute; ft = feet; d = day							

Figure 17 provides the time-drawdown plot (Cooper-Jacob) for Well D. The plot shows that there are 5 slopes that fit the data. During the first 10 minutes of the test, the Cooper-Jacob method is not applicable since u is larger than 0.05. The remaining slopes provide varying transmissivity values ranging from 11,700 $ft.^2$/day to 949 $ft.^2$/day. Driscoll (1986) states *"it should be pointed out that calculation of transmissivity, T, of a water-bearing formation must be made from Δ s based on the first part of the time-drawdown curve."* Driscoll further states that *"other Δ s values cannot be used because physical characteristics of the aquifer are somewhat different farther from the well."* In addition, the slope between 100 and 1,000 minutes (Appendix H) was chosen for the Cooper-Jacob analysis due to the ability of the resulting transmissivity value to recreate actual measured drawdown during the aquifer test when utilizing the modified non-equilibrium equation or Theis equation. Most commonly, these types of curve-matching techniques are applied to achieve the optimal fit between theoretical relationships (e.g. Theis) and measured field data (BSEACD, 2007).

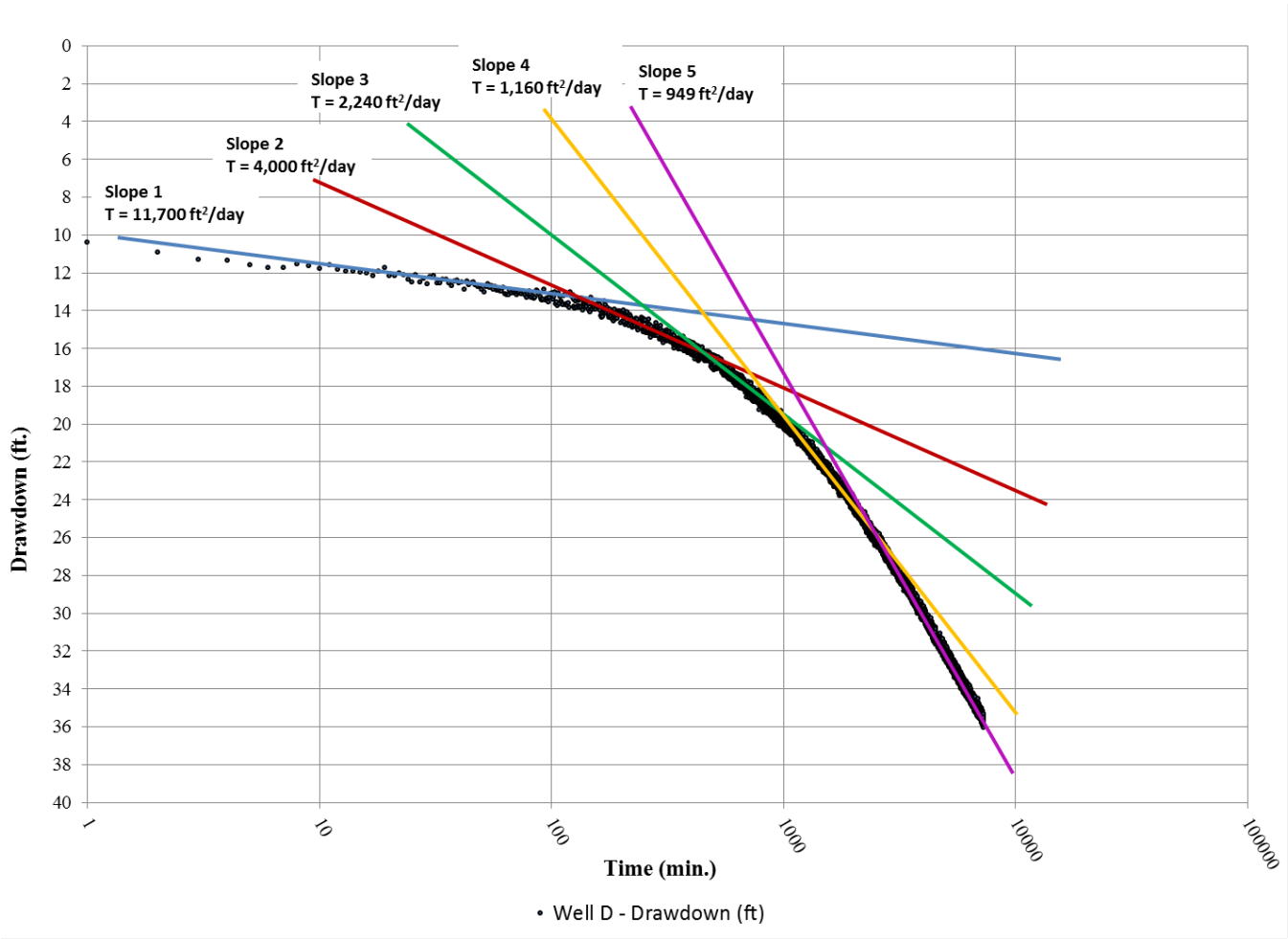


Figure 17: Well D Cooper-Jacob time-drawdown plot

As required by the BSEACD Guidelines for Hydrogeologic Reports, the effects of current and projected pumpage on water levels on surrounding wells for a one and three year period was estimated using the Theis equation. Figure 19 shows the estimated drawdown for 1and 3 years of continuous pumping of Well D at 550 gpm, representing the pumping rate at the requested production permit. The accurate estimation of water levels due to pumping within a karst aquifer such as the Middle Trinity Aquifer over long term periods of production, however, is difficult. The heterogeneity of the Middle Trinity Aquifer in addition to potential disconnects between the Cow Creek Member and other formations causes traditional methods of estimating drawdown, such as the Theis equation, to overestimate drawdown. The use of the state's Groundwater Availability Model (GAM) to estimate drawdown from a single well also has limitations due to scaling because the models are regional in nature. In addition, the GAM for the Trinity Aquifers neither covers the full extent of the project area nor the confined zone of the aquifers. In an effort to satisfy the requirements of the BSEACD we used the Theis equation (Driscoll, 1986) to estimate drawdown. The Theis equation has several critical assumptions used to derive the formula which include:

1. The water-bearing formation is uniform in character and the hydraulic conductivity is the same in all directions;

2. The aquifer is uniform in thickness and infinite in areal extent;
3. The aquifer receives no recharge from any source;
4. The well penetrates, and receives water from the full thickness of the aquifer;
5. The water from storage is discharged instantaneously when the head is lowered;
6. The pumping well is 100% efficient;
7. All water removed from the well comes from aquifer storage;
8. Laminar flow exists through the well and aquifer; and,
9. The water table or potentiometric surface has no slope.

It is important to note that several of the assumptions used to derive the Theis equation are not appropriate for the Middle Trinity Aquifer and specifically wells completed within the Cow Creek Member. These include assumptions 1, 3, 7 and 8. The Middle Trinity Aquifer is a karst aquifer and is fractured, not uniform or homogenous in character or in its hydrogeologic properties (transmissivity and storativity). In addition, the Theis assumptions that (i) the formation receives no recharge from any source and (ii) that all water removed from the well comes from aquifer storage are inaccurate and, therefore, inappropriate, for application to the Middle Trinity Aquifer. Driscoll (1986) states,

> *"The assumption that an aquifer receives no recharge during the pumping period is one of the six fundamental conditions upon which the non-equilibrium formulas (Theis) are based. Therefore, all water discharged from a well is assumed to be taken from storage within the aquifer. It is known, however that most formations receive recharge. Hydrographs from long-term observation wells monitored by the US Geological Survey, various state agencies, and similar data-gathering agencies in other parts of the world show that most water-bearing formations receive continual or intermittent recharge."*

Furthermore, contrary to the Theis assumptions, Konikow and Leake (2014) note that with increased pumping time, (i) the fraction of pumpage derived from storage tends to decrease, and (ii) the fraction derived from capture (recharge) increases. Eventually a new equilibrium will be achieved when no more water is derived from storage and heads, or water levels, in the aquifer stabilize (Figure 18). This result is achieved when the initial cone of depression formed by discharge reaches a new source of water, typically the recharge zone of the aquifer. The actual response time for an aquifer system to reach a new equilibrium is a function of the dimensions, hydraulic properties, and boundary conditions for each specific aquifer. For example, the response time will decrease as the hydraulic diffusivity of the aquifer increases (Theis 1940; Barlow and Leake 2012). The response time can range from days to millennia (Bredehoeft and Durbin 2009; Walton 2011).

Since the Theis equation assumes (i) that all water is derived from storage and (ii) that the aquifer receives no recharge, the Theis equation overestimates drawdown within a well that is located in an aquifer that receives recharge rapidly. Hydrographs of wells (Figure 10) confirm that the Middle Trinity

Aquifer exhibits increases in water level quickly after precipitation events. For this reason, using the Theis equation to calculate drawdown over periods of time greater than when water from capture exceeds water from storage leads to an exaggerated estimate of drawdown.

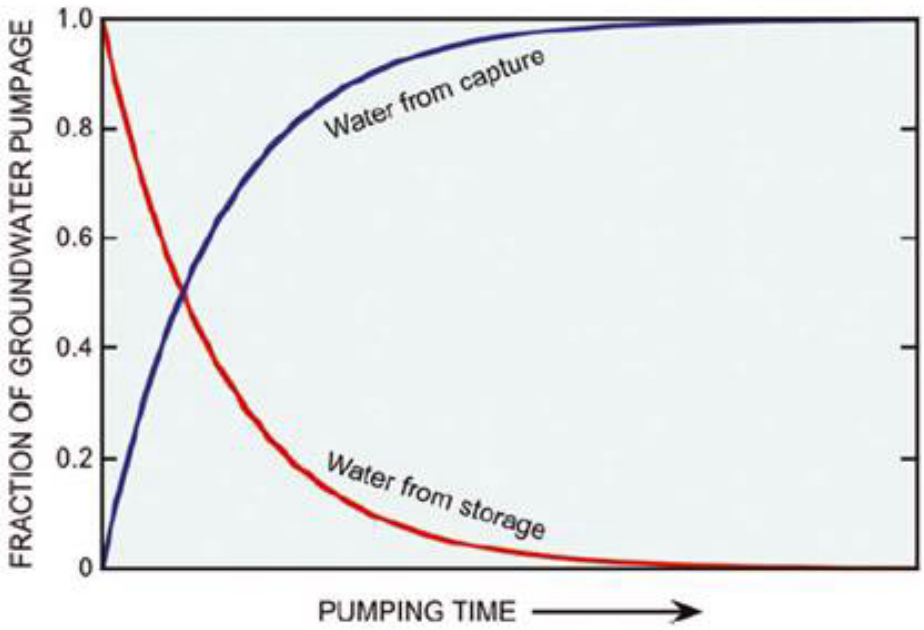


Figure 18: Water sources to a pumping well over time (from Konikow and Leake (2014))

Figure 19 provides a graph of the distance-drawdown calculations for 1 and 3 years using the Theis equation. The average transmissivity at Well D (4,040 $ft.^2/day$) from the Cooper-Jacob, Theis and Theis Recovery methods and average storativity values (1.63×10^{-4}) from the Cooper-Jacob and Theis methods were used to model the drawdown. At one year and three years the drawdown at Well D was modeled at 55.28 ft. and 57.57 ft., respectively using the Theis equation.

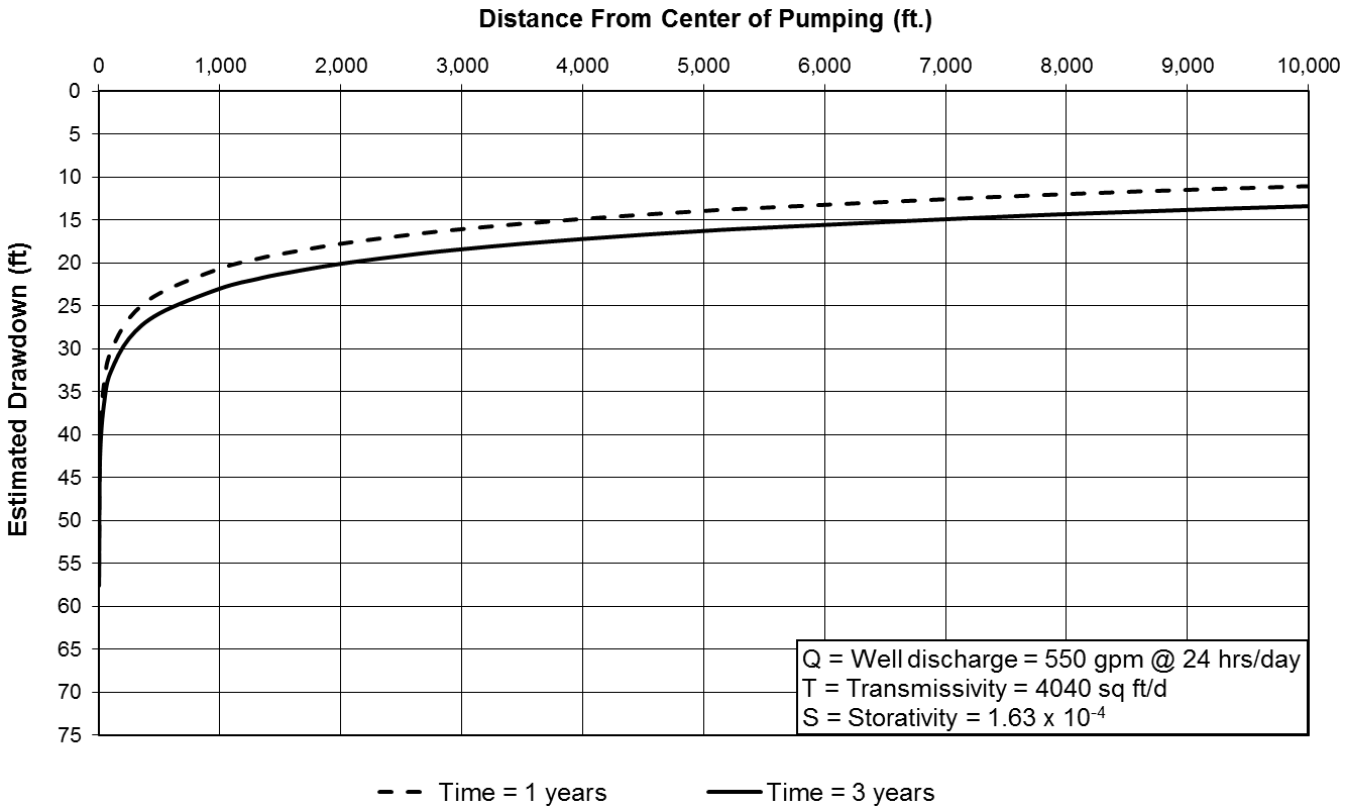


Figure 19: Needmore Well D distance-drawdown estimations

During the aquifer testing, precipitation and stream flow on the Trinity Aquifer recharge zone from EAA rain gauge HA157 and USGS flow stations 08171000 (Blanco River at Wimberley) and 08171300 (Blanco River near Kyle) were monitored to determine potential influences from pumping Well D. Figure 20 provides a graph of the precipitation and stream flow data for each site. According to the EAA rain gauge, there was a minor precipitation event during the aquifer testing. The hydrograph indicates no observable influence from either precipitation or the pumping of Well D.

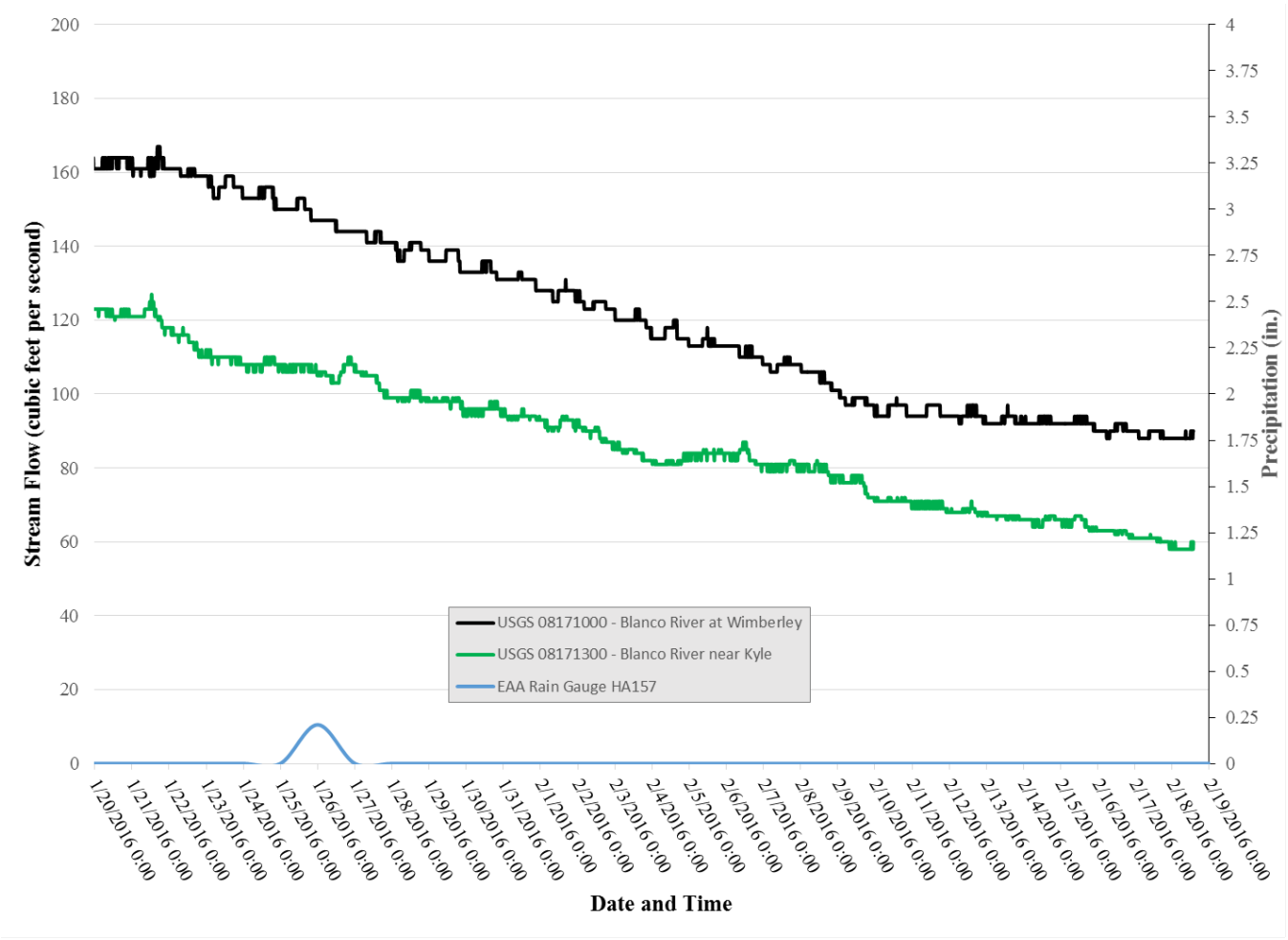


Figure 20: Hydrographs for the Blanco River near Needmore

During the aquifer testing, precipitation and discharge rate from Jacob's Well Spring were analyzed to determine if there were any effects on discharge rates from pumping Well D. Precipitation data was obtained from EAA rain gauge HA157 and the USGS station 08170990 (Jacob's Well Spring). Figure 21 provides a graph of the precipitation and discharge data. The hydrograph indicates no observable influence on discharge from either precipitation or the pumping of Well D.

Figure 21: Discharge rate from Jacob's Well

VII.4. Water Quality

During the aquifer test, a water sample was obtained using methods approved by the Texas Commission on Environmental Quality (TCEQ) and taken to a laboratory certified by the National Environmental Laboratory Accreditation Conference (NELAC). Table 7 provides a summary of the water quality test results. Appendix I includes the laboratory water quality reports. The water quality parameters analyzed were outlined in the Well D aquifer test work plan approved by BSEACD staff. The Total Dissolved Solids (TDS) concentration analysis was 1,000 mg/L with a sulfate concentration of 507 mg/L.

Table 7: Water quality summary

			units in mg/L									
Well	**Date**	**pH**	**TDS**	**HCO_3**	**SO_4**	**Cl**	**F**	**Fe**	**Ca**	**Mg**	**K**	**Na**
Well D	1/29/2016	7.5	1,000	277	507	30	1.76	0.256	161.0	83.7	8.7	29.5
Notes: Sample taken 4 days after start of aquifer test; mg = milligrams; L = liter												

Table 8 provides the data collected during the Well D aquifer test, including pH and specific conductance taken at various times during the pumping phase of the aquifer test. The results indicate that the pH and specific conductance stabilized through the test. The specific conductance decreased throughout the test with the exception of the final reading, which could be due to a different instrument used to measure the parameter by BSEACD staff (Table 9). The final readings are indicative of native Middle Trinity Aquifer groundwater. No negative impacts to water quality are anticipated with prolonged production from Well D.

Table 8: Water quality field parameters summary

Well	**Date**	**pH**	**Specific Conductance (uS/cm)**	**Dissolved Oxygen (mg/L)**	**Turbidity (NTU)**
Well D	1/25/2016	6.1	2,670	-	-
	1/26/2016	6.6	1,280	-	-
	1/27/2016	6.8	1,250	-	-
	1/28/2016	6.7	1,250	-	-
	1/29/2016*	7.4	1,350	6.0	1.0
Notes: *measurement taken by BSEACD staff; all other readings by Wet Rock					

Section VIII: Conclusions

This report details the results of a hydrogeologic report of Well D to meet the guidelines mandated by the BSEACD for an existing well (Well D) that will serve the Needmore River Ranch in south central Hays County. Needmore Water is seeking to produce 289,080,000 gallons per year (approximately 887 acre-feet/year; 550 gallons per minute (gpm)) from Well D, pending a production permit from the BSEACD. Well D is located along Fulton Ranch Road approximately 7 miles northwest of the City of San Marcos, Texas. The conclusions from this report are as follows:

- Needmore Water was granted a temporary production permit for 179,964,440 gallons per year (552.3 acre-feet/year; approximately 342 gpm) from BSEACD based upon BSEACD staff's interpretation of language in HB 3405 of the 84th Texas Legislature. However, the volume granted for the temporary production permit was below what Needmore Water applied for based upon the Maximum Production Capacity of Well D as outlined in HB 3405, as of the legislation's effective date. Well D was completed in February 2013 prior to HB 3405 being enacted by the 84th Texas Legislature in May of 2015;

- The Well D production schedule will be dependent upon multiple factors, including landowner demands, use and development of the Needmore Ranch (5,000 acres) and weather conditions such as precipitation and evapotranspiration. Peak irrigation demand hours are projected for the early morning hours to reduce water loss to evapotranspiration and heat. Projected annual pumping demands for the next three years were estimated at an equal amount of 72.27 million gallons for each quarter, however the demand could vary depending on weather conditions;

- According to the geophysical log conducted at Well D, the Edwards Aquifer is present from ground surface to 89 feet below ground surface (ft. bgs), the Upper Trinity Aquifer is present from 89 ft. bgs to 468 ft. bgs, and the Middle Trinity Aquifer is present from 468 ft. bgs to 798 ft. bgs. The Middle Trinity Aquifer is under confined conditions;

- A well site investigation conducted on January 28, 2016 indicated that no known recharge features or springs that affect the Middle Trinity Aquifer are located within a mile of Well D. The Blanco River is the only major surface water body located near Well D; Sycamore Creek and the Water Storage Pond on the creek are considered minor surface water bodies. Neither surface water body directly influences Well D;

- An aquifer test was conducted on the well to demonstrate the ability of Well D to provide water to the Needmore River Ranch without any unreasonable impacts on neighboring wells and to satisfy BSEACD's aquifer testing requirements. The majority of water produced from the well was within the Cow Creek Member of the Middle Trinity Aquifer;

- During the aquifer test, Well D was pumped for over 120 hours at an average rate of 544 gpm with 35.3 feet of drawdown, resulting in a specific capacity of 15.4 gpm/ft. Aquifer properties were calculated using the Cooper-Jacob, Theis, and Theis Recovery methods.

Transmissivity values using the Cooper-Jacob (4,000 $ft.^2$/day), Theis (4,050 $ft.^2$/day) and Theis Recovery (4,070 $ft.^2$/day) methods resulted in similar values. Average storativity values using the Cooper-Jacob (1.0×10^{-4}) and Theis (2.26×10^{-4}) methods also had good agreement;

- During the aquifer test, production from Well D was maintained at a steady rate with water levels that remained relatively stable throughout the test. The aquifer test data indicate that at Well D there were no effects from nearby pumping of surrounding wells and no significant recharge or discharge boundaries experienced;

- The accurate estimation of water levels due to pumping within a karst aquifer such as the Middle Trinity Aquifer over long term periods of production is difficult. The heterogeneity of the aquifer, in addition to potential disconnects between the Cow Creek Member and other formations, causes traditional methods of estimating drawdown such as the Modified Non-equilibrium Equation or Theis Equation to overestimate drawdown. Since the Theis Equation assumes that all water is derived from storage and that the aquifer receives no recharge, Theis overestimates drawdown within a well that is located in an aquifer that receives recharge rapidly. For this reason, using the Theis Equation to calculate drawdown over periods of time greater than when water from capture exceeds water from storage leads to an exaggerated estimate of drawdown;

- To satisfy the BSEACD requirements, distance-drawdown calculations for 1 and 3 years of continuous pumping were conducted using the Theis equation. At one year and three years the drawdown at Well D was estimated at 55.28 ft. and 57.57 ft., respectively. The average transmissivity at Well D (4,040 $ft.^2$/day) and average storativity values (1.63×10^{-4}) were used to model drawdown;

- During the Well D aquifer testing, precipitation and stream flow on the Trinity Aquifer recharge zone from rain gauges and flow stations were monitored to determine potential influences from pumping the Well D. According to the rain gauge data collected from the vicinity of Well D, there was only minor precipitation during the aquifer testing. The hydrograph indicate no observable influence from pumping Well D;

- During the aquifer testing, precipitation and discharge rate from Jacob's Well Spring were analyzed to determine if there were any effects on discharge rates from pumping Well D. The hydrograph indicates no observable influence on discharge from precipitation or the pumping of Well D; and

- The water quality parameters analyzed for groundwater produced from Well D were outlined in the aquifer test work plan approved by BSEACD staff. The measured Total Dissolved Solids (TDS) concentration in Well D was 1,000 mg/L with a sulfate concentration of 507 mg/L.

Section IX: References

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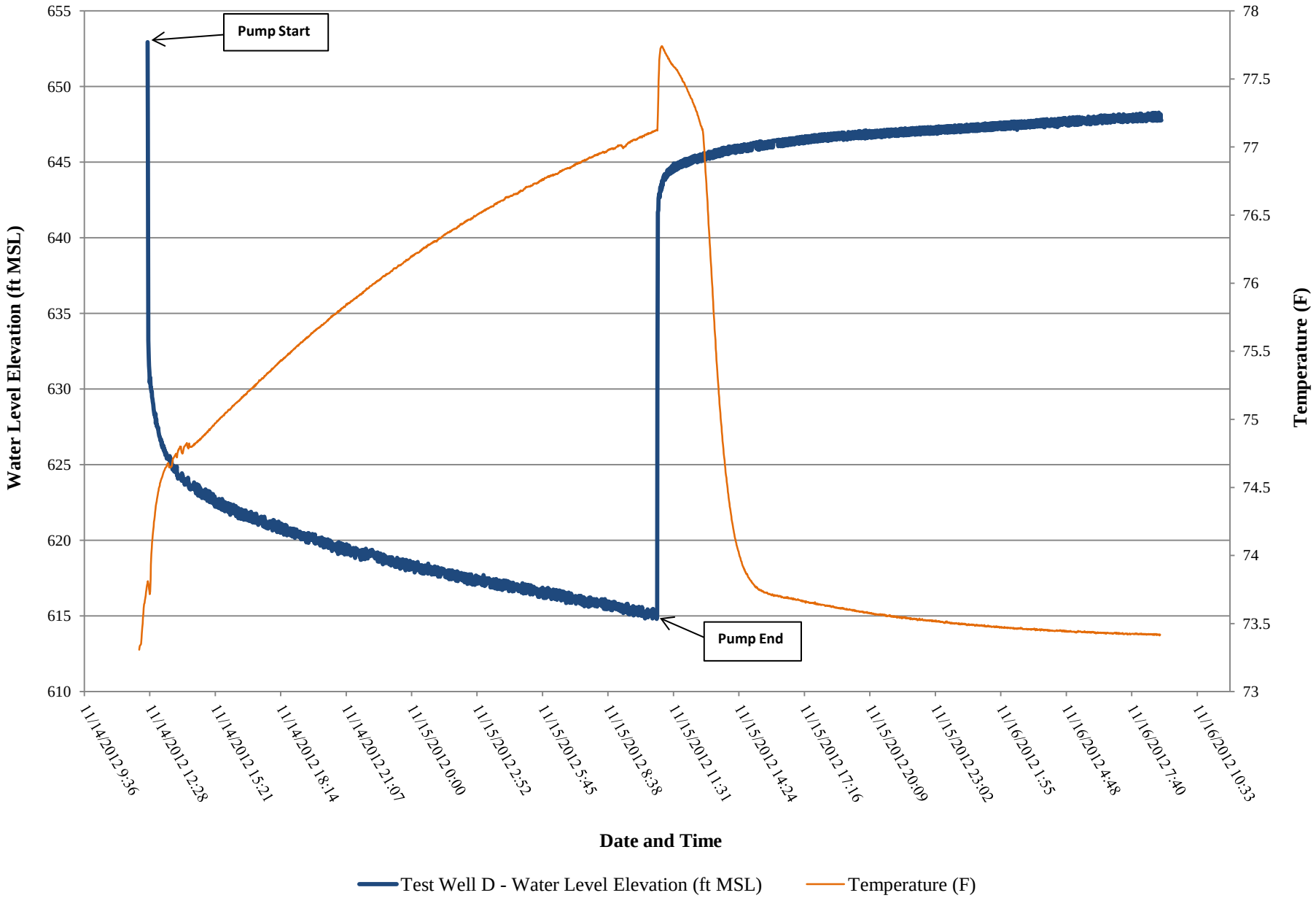
Appendix A

Aquifer Test of Well D (Nov. 14, 2012)

Needmore River Ranch - Test Well D - Aquifer Test (November 14, 2012)



Needmore River Ranch - Test Well D - Aquifer Test (November 14, 2012)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Comments
11/14/2012 12:22	0		73.80	287.07	652.93	0.00			Pump Start
11/14/2012 12:23	1		73.81	292.23	647.77	5.16	440	85.21	Meter = 13,684,645 gallons
11/14/2012 12:24	2		73.80	306.78	633.22	19.71	435	22.07	
11/14/2012 12:25	3		73.78	307.98	632.02	20.91			
11/14/2012 12:26	4		73.76	308.45	631.55	21.38			
11/14/2012 12:27	5		73.73	308.93	631.07	21.86	435	19.90	
11/14/2012 12:28	6		73.72	309.58	630.42	22.52			
11/14/2012 12:29	7		73.74	309.22	630.78	22.15			
11/14/2012 12:30	8		73.83	309.90	630.11	22.83	435	19.06	
11/14/2012 12:31	9		73.93	309.87	630.13	22.80			
11/14/2012 12:32	10		74.01	310.16	629.84	23.09	435	18.84	
11/14/2012 12:33	11		74.06	310.16	629.84	23.10			
11/14/2012 12:34	12		74.10	310.53	629.47	23.46			
11/14/2012 12:35	13		74.13	310.67	629.33	23.60			
11/14/2012 12:36	14		74.15	310.83	629.17	23.76			
11/14/2012 12:37	15		74.19	311.00	629.00	23.93	435	18.18	
11/14/2012 12:42	20		74.32	311.85	628.15	24.78	435	17.55	
11/14/2012 12:47	25		74.41	312.36	627.64	25.29	435	17.20	
11/14/2012 12:52	30		74.49	312.93	627.07	25.86	435	16.82	
11/14/2012 13:07	45		74.63	314.16	625.84	27.09	430	15.87	
11/14/2012 13:22	60		74.65	314.95	625.05	27.88	430	15.42	
11/14/2012 13:37	75		74.75	315.48	624.52	28.41	430	15.14	
11/14/2012 13:52	90		74.76	316.06	623.95	28.99	430	14.83	
11/14/2012 14:07	105		74.80	316.25	623.75	29.18	430	14.74	
11/14/2012 14:22	120		74.81	316.37	623.64	29.30	430	14.68	
11/14/2012 15:22	180		74.97	317.29	622.71	30.22			
11/14/2012 16:22	240		75.14	318.54	621.46	31.47			
11/14/2012 17:22	300		75.30	318.43	621.57	31.36			
11/14/2012 18:22	360		75.45	319.62	620.38	32.55			
11/14/2012 19:22	420		75.60	319.60	620.40	32.53			
11/14/2012 20:22	480		75.74	320.13	619.87	33.06			
11/14/2012 21:22	540		75.87	320.56	619.44	33.49			
11/14/2012 22:22	600		76.00	320.99	619.01	33.92			
11/14/2012 23:22	660		76.12	321.50	618.50	34.43			
11/15/2012 0:22	720		76.24	322.13	617.87	35.06			
11/15/2012 1:22	780		76.35	321.90	618.10	34.83			
11/15/2012 2:22	840		76.45	322.56	617.44	35.49			

Note: bgs = below ground surface Column Pipe Diameter = 4-inch Horsepower = 60 HP
MSL = Mean Sea Level Pump Setting = 588 feet bgs

Needmore River Ranch - Test Well D - Aquifer Test (November 14, 2012)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Comments
11/15/2012 3:22	900		76.55	322.82	617.18	35.75			
11/15/2012 4:22	960		76.64	322.85	617.15	35.78			
11/15/2012 5:22	1020		76.73	323.12	616.88	36.05			
11/15/2012 6:22	1080		76.80	323.58	616.42	36.51			
11/15/2012 7:22	1140		76.88	324.08	615.92	37.01			
11/15/2012 8:22	1200		76.96	323.90	616.10	36.84			
11/15/2012 9:22	1260		77.00	324.70	615.30	37.63			
11/15/2012 10:22	1320		77.10	324.56	615.44	37.49			
11/15/2012 10:47	1345	0	77.13	325.06	614.95	37.99	428	11.27	Pump Stop
11/15/2012 10:48	1346	1	77.12	310.48	629.52	23.42			Meter = 14,260,550 gallons
11/15/2012 10:49	1347	2	77.24	298.31	641.69	11.24			
11/15/2012 10:50	1348	3	77.37	298.18	641.82	11.11			
11/15/2012 10:51	1349	4	77.48	297.39	642.61	10.32			
11/15/2012 10:52	1350	5	77.57	297.20	642.81	10.13			
11/15/2012 10:53	1351	6	77.64	297.06	642.94	9.99			
11/15/2012 10:54	1352	7	77.68	297.33	642.67	10.26			
11/15/2012 10:55	1353	8	77.70	296.72	643.28	9.65			
11/15/2012 10:56	1354	9	77.72	296.64	643.36	9.57			
11/15/2012 10:57	1355	10	77.73	296.92	643.08	9.85			
11/15/2012 10:58	1356	11	77.74	296.43	643.57	9.37			
11/15/2012 10:59	1357	12	77.74	296.78	643.22	9.71			
11/15/2012 11:00	1358	13	77.74	296.23	643.78	9.16			
11/15/2012 11:01	1359	14	77.74	296.57	643.43	9.50			
11/15/2012 11:02	1360	15	77.73	296.50	643.50	9.43			
11/15/2012 11:07	1365	20	77.70	295.80	644.20	8.73			
11/15/2012 11:12	1370	25	77.67	295.99	644.01	8.93			
11/15/2012 11:17	1375	30	77.65	295.84	644.16	8.77			
11/15/2012 11:32	1390	45	77.59	295.54	644.46	8.47			
11/15/2012 11:47	1405	60	77.53	295.36	644.64	8.29			
11/15/2012 12:02	1420	75	77.45	294.88	645.12	7.81			
11/15/2012 12:17	1435	90	77.36	294.69	645.31	7.62			
11/15/2012 12:32	1450	105	77.26	294.61	645.39	7.54			
11/15/2012 12:47	1465	120	77.13	294.85	645.15	7.78			
11/15/2012 13:47	1525	180	74.64	294.06	645.94	6.99			
11/15/2012 14:47	1585	240	73.85	293.83	646.17	6.76			
11/15/2012 15:47	1645	300	73.71	293.62	646.38	6.55			
11/15/2012 16:47	1705	360	73.69	293.79	646.21	6.72			

Note: bgs = below ground surface Column Pipe Diameter = 4-inch Horsepower = 60 HP
MSL = Mean Sea Level Pump Setting = 588 feet bgs

Needmore River Ranch - Test Well D - Aquifer Test (November 14, 2012)

Date and Time	Time Since Pump Start (min)	Time Since Pump Stop (min)	Temperature (F)	Water Level (ft bgs)	Water Level (ft MSL)	Drawdown (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Comments
11/15/2012 17:47	1765	420	73.65	293.22	646.78	6.15			
11/15/2012 18:47	1825	480	73.61	293.09	646.91	6.02			
11/15/2012 19:47	1885	540	73.59	293.36	646.64	6.29			
11/15/2012 20:47	1945	600	73.56	292.87	647.13	5.80			
11/15/2012 21:47	2005	660	73.54	293.20	646.80	6.13			
11/15/2012 22:47	2065	720	73.52	293.10	646.90	6.03			
11/15/2012 23:47	2125	780	73.50	293.02	646.98	5.95			
11/16/2012 0:47	2185	840	73.49	292.94	647.06	5.87			
11/16/2012 1:47	2245	900	73.47	292.81	647.19	5.74			
11/16/2012 2:47	2305	960	73.46	292.70	647.30	5.63			
11/16/2012 3:47	2365	1020	73.45	292.20	647.80	5.13			
11/16/2012 4:47	2425	1080	73.45	292.54	647.46	5.47			
11/16/2012 5:47	2485	1140	73.43	292.06	647.94	4.99			
11/16/2012 6:47	2545	1200	73.43	292.30	647.70	5.23			
11/16/2012 7:47	2605	1260	73.43	291.89	648.11	4.82			
11/16/2012 8:47	2665	1320	73.42	292.26	647.74	5.19			
11/16/2012 8:58	2676	1331	73.41	292.23	647.77	5.16			

Note: bgs = below ground surface Column Pipe Diameter = 4-inch Horsepower = 60 HP
MSL = Mean Sea Level Pump Setting = 588 feet bgs

Wet Rock Groundwater Services, LLC
Groundwater Specialists
311 Ranch Road 620 South, Suite 103
Austin, Texas 78734
Ph: 512.773.3226
www.wetrockgs.com

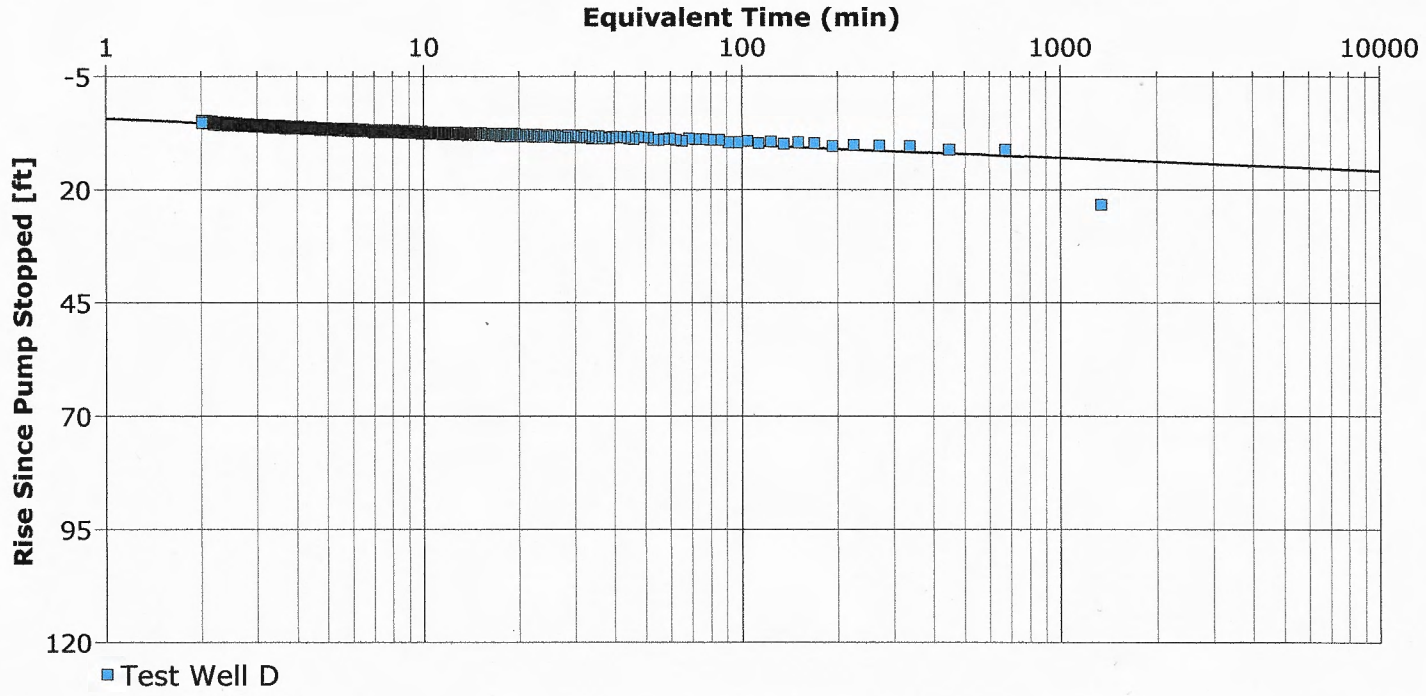
Pumping Test Analysis Report

Project: Needmore River Ranch

Number: 079-001-12

Client: Needmore Ranch II, Ltd

Location:	Pumping Test: Test Well D	Pumping Well: Test Well D
Test Conducted by: BWB		Test Date: 11/14/2012
Analysis Performed by: BWB	Theis Recovery	Analysis Date: 11/16/2012
Aquifer Thickness: 703.00 ft	Discharge: variable, average rate 428.29 [U.S. gal/min]	



Calculation after Theis & Jacob

Observation Well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Radial Distance to PW [ft]	
Test Well D	5.23×10^3	7.45×10^0		

Appendix B

Needmore Water, LLC Temporary Production Permit

Barton Springs Edwards Aquifer
CONSERVATION DISTRICT

October 19, 2015

Sent via certified mail and email

Edmund R. McCarthy
Jackson, Sjoberg, McCarthy & Townsend, LLP
711 West 7th Street
Austin, TX 78701

RE: Temporary Production Permit for Needmore Water LLC

Dear Mr. McCarthy:

The purpose of this letter is to transmit the Temporary Production Permit for Needmore Water LLC's (Needmore) "Well D" issued by the Barton Springs Edwards Aquifer Conservation District (District). The District has designated the well for Agricultural Livestock use and is initially setting the authorized withdrawal volume of Well D at 179,965,440 gallons with a special condition prohibiting operation of the well based on evidence of damage to the well and its current inoperable condition. This letter describes the basis for the permit terms, requests additional action by Needmore related to satisfying the special condition, and requests a meeting with you.

I. Maximum Production Capacity

The District has evidence indicating that Well D is damaged/deteriorated and incapable of producing any groundwater at this time. In addition, the 887 acre-feet requested in the application does not appear feasible, and therefore does not meet the District's interpretation of the meaning of the term "maximum production capacity".

Although, no standard definition of "Maximum Production Capacity" of a well can be found in the technical literature. The term is similar to *well yield*, which is the volume of water per unit of time discharged from a well (Driscoll, 1986). The well yield is calculated when the "pumping" water level in the well stabilizes (Todd and Mayes, 2005). Inherent to any well yield or well capacity definition is the concept that no harm will occur to the well or pump during the long-term operation of the well, and the yield is practical and feasible. Since this term may apply to long-term (annual) permitting considerations, the definition needs to be firmly rooted in data, and not speculative or theoretical estimates. Further, the term needs to represent the practical limitations of an actual operating well, realistic pumping durations, and time needed for recovery. On the basis of these practical considerations, the General Manager interprets the meaning of the term "maximum production capacity" as follows:

> ***Maximum Production Capacity:*** *The amount of water that can be produced from a well completed in compliance with applicable well construction standards that: 1) achieves a stable pumping level and 2) will not cause adverse effects to the pump or well after long-term operation. The amount may be based on a 36-hour pump test and considers the practical operation duration as 80% of the annual permit term. Inherent to this definition is the correct design of the pump (size, efficiency) for the given well construction and conservative aquifer parameters (head, transmissivity).*

Pump test information submitted with the application indicated an actual pumping rate of 428 gpm and a test duration of approximately 22 hours. Although the testing was not conducted for the requisite 36-hour duration and did not achieve a stable pumping level, the General Manager has determined that, given the limited information, the appropriate authorized volume shall be calculated based on the actual pump test pumping rate of 428 gpm at 80% of the annual permit term. Accordingly, the calculated annual Temporary Production Permit volume is 179,965,440 gallons.

Please also note that the Temporary Production Permit does not authorize groundwater production until such time that the well has been brought into compliance with applicable rules related to well construction standards and maintaining the well in good non-deteriorated condition. The District requests that the applicant provide a plan describing how it will address the well condition as a required component of the Regular Permit application requirements.

II. Use Type

The relevant use type for issuance of the Temporary Production Permit is determined by evaluating the period of time Well D operated before the effective date of HB 3405 (June 19, 2015). The September 19, 2015 Needmore permit application indicated both general and agricultural use types prior to June 19, 2015, however, the information provided was insufficient to clearly designate the primary use type.

Supplemental information provided in response to the District's written requests and information obtained from the District's October 14, 2015 site visit indicated that the well was used solely to supplement a ponded water feature which is used primarily for recreation (swimming, fishing, and boating) and for wildlife. On the basis of this information, the District is initially characterizing the use type for Well D as Agricultural Livestock. Although the well is not used to support livestock on the Needmore Ranch, the definition of this use under District Rule 2.1 includes "wildlife management." District Rule 2.1 defines wildlife management to include "the watering and/or feeding of free-ranging, non-caged, wild animals under a management plan approved by TPWD, US Fish and Wildlife Service, or other governmental agency with authority to approve and regulate wildlife management plan." While you have confirmed the existence of a plan, the District has not received a copy of the plan. Please provide a copy of the "active plan" referenced in the October 15, 2015 within 30 days of the date of this letter. The District requires a copy of the plan as it processes the Regular Permit.

III. Transport of Groundwater Outside the District

The pond supplied by Well D is located outside the boundaries of the District. The District is in the process of reviewing whether transport of water from Well D outside the District is authorized under HB 3405 or whether a transport permit and fees are required as would be the case under existing rules applicable to permit holders. Additional guidance will be provided to Needmore during the processing of the Regular Permit.

IV. Meeting

The District requests a meeting with you and Mr. Khorzad to discuss the issues identified by the District, including providing additional information on well use, transport of water outside the District, and maximum production capacity.

Finally, the District appreciates the responses demonstrated by you and Mr. Khorzad, including arranging a site visit, during the short time frame required to process the Temporary Production Permit.

References

Driscoll, F.G., 1986, Groundwater and Wells, 2nd edition Johnson Screens, St. Paul Mn, 1089 p.

Todd, D.K., and L.W. Mays, 2005, Groundwater Hydrology, 3rd edition, John Wiley & Sons, Inc. 636 p.

Sincerely,

John T. Dupnik, P.G.
General Manager

cc:

Wet Rock Groundwater Services, LLC
317 Ranch Rd 620 South, Suite 203
Austin, TX 78734

Needmore Water LLC
3900 N. McColl Rd
McAllen, TX 78501

Bill Dugat
Bickerstaff Heath Delgado Acosta LLP
3711 S. Mo-Pac, Suite 300
Austin, TX 78746

Barton Springs/Edwards Aquifer Conservation District

512-282-8441 ~ 1124 Regal Row Austin, TX 78748 ~ www.bseacd.org

Temporary Production Permit
Permit No: T015-10-2015

Owner:	Needmore Water LLC (Greg LaMantia)
System:	Needmore Water LLC (Greg LaMantia)
Mailing Address:	3900 N. McColl Rd McAllen, TX 78501
Physical Well Address:	Fulton Ranch Rd Wimberley, TX 78676
Management Zone:	Upper/Middle Trinity Management Zone
Aquifer:	Upper/Middle Trinity Aquifer
Number of Wells:	1

Terms: This permit is effective for the period of time between June 19, 2015 and the date that the District makes a final, appealable action on the issuance of a Regular Production Permit in accordance with District Rule 3-1.55.2.C.

This permit expires on August 31st of each year and, unless a Regular Production permit has been issued, is automatically renewed on September 1st of each year, granted that the permittee:

1. Operates the well consistent with the authorization in the permit application;
2. Timely pays all fees; and
3. Complies with all District rules, orders, permit conditions, permit requirements and terms of this permit.

Failure to pay fees, report pumpage, or abide by Rules, Bylaws, or Special Provisions of issuance, will subject this Permit to revocation. Permittee is subject to the enforcement mechanisms available to the District for any violation of applicable District Rules or Bylaws.

Permitted Groundwater Withdrawal: Only that amount of water which is required without being wasteful during the term of this Permit, but not to exceed: **179,965,440** gallons/year

Special Provisions: The permitted groundwater withdrawal volume is not authorized for production until 1) the Permittee has provided adequate documentation that the well has been repaired in accordance with applicable well construction standards, 2) the well is in good, non-deteriorated condition in accordance with Permit Condition #15 of this Permit, and 3) the well complies with the applicable requirements of 16 TAC 76.1004 and with District Rule 3-5.

Issued By: _____ **This Permit is hereby issued on:** 10/19/2015
John Dupnik, P.G., BSEACD General Manager

PERMIT CONDITIONS AND REQUIREMENTS

All permits are granted subject to the Rules, regulations, Orders, special provisions, and other requirements of the Board, and the laws of the State of Texas. In addition, each permit issued shall be subject to the following conditions and requirements:

1. The Temporary Production Permit is granted in accordance with the provisions of H.B. 3405 of the 84th Texas Legislature in conjunction with Chapter 36, Texas Water Code, and the Rules, regulations and Orders of the District and acceptance of the permit constitutes an acknowledgment and agreement that the permittee will comply with all the terms, provisions, conditions, requirements, limitations, and restrictions embodied in the permit and with the Rules, regulations, and Orders of the District applicable to permit holders.

2. The Temporary Permit does not confer any rights and privileges to the well owner or permittee other than those set forth in this Section.

3. Any person who relies on the Temporary Permit to drill, operate, or engage in other activities associated with a water well assumes the risk that the District may grant or deny, wholly or partly, the permit application when the District takes final action after notice and hearing to issue a Regular Production Permit pursuant to the application.

4. A functioning water meter must be installed within 30 days of the issuance of the Temporary Permit pursuant to Rule 3-2.

5. The permittee shall keep accurate records and meter readings, on a monthly basis, of the amount of groundwater withdrawn, the purpose of the withdrawal. Such records shall be submitted to the District office on a monthly basis, unless some other reporting period is specified in the permit, even if there is zero pumpage or transport for the time period and shall also be available for inspection at the permittee's principal place of business by District representatives. Immediate written notice shall be given to the District in the event a withdrawal of water exceeds the quantity authorized by the permit or rules.

6. Production shall not exceed the permitted volume authorized in the Temporary Production Permit.

7. The produced water shall be dedicated to beneficial use at all times.

8. The Temporary Production permittee is not required to comply with provisions of Rule 3-7 related to temporary drought curtailments.

9. The drilling and operation of the well for the authorized use shall be conducted in such a manner as to avoid waste, pollution, or harm to the aquifer.

10. The well site shall be accessible to District representatives for inspection during normal business hours and during emergencies. The permittee agrees to cooperate fully in any reasonable inspection of the well site related monitoring or sampling by District representatives. The well owner shall provide a 24-hour emergency contact to the District.

11. The application pursuant to which the permit has been issued is incorporated herein, and the permit is granted on the basis of and contingent upon the accuracy of the information

supplied in that application and in any amendments thereof. A finding that false information has been supplied shall be grounds for immediate revocation of the permit. In the event of conflict between the provisions of the permit and the contents of the application, the provisions of the permit shall prevail.

12. Violation of the permit's terms, conditions, and requirements, including pumping amounts in excess of authorized withdrawal, shall be punishable by civil penalties as provided by Special District Local Laws Code Chapter 8802 and the District Rules.

13. The Temporary Permit holder shall timely pay to the District all administrative fees and fees related to the amount of groundwater authorized to be produced pursuant to the Temporary Permit and District Rule 3-1.16 related to Fees and Payment of Fees.

14. Violation of the permit's terms, conditions, or requirements including pumping amounts in excess of authorized withdrawal shall be punishable by civil penalties as provided by Special District Local Laws Code Chapter 8802 and the District Rules.

15. The well authorized by this Permit must be maintained in good, non-deteriorated condition in compliance with District Rule 5 related to the District well construction standard.

Appendix C

House Bill 3405

AN ACT

relating to the territory, jurisdiction, and powers of the Barton Springs-Edwards Aquifer Conservation District, including its authority to regulate certain wells for the production of groundwater; imposing a cap on certain fees.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 1. Subchapter A, Chapter 8802, Special District Local Laws Code, is amended by adding Section 8802.0035 to read as follows:

Sec. 8802.0035. SHARED TERRITORY; JURISDICTION. (a) The territory of the district includes any territory that is:

(1) inside the boundaries of:

(A) the Edwards Aquifer Authority; and

(B) Hays County; and

(2) not within the boundaries of the Plum Creek Conservation District as those boundaries existed on February 1, 2015.

(b) The Edwards Aquifer Authority has jurisdiction over any well that is drilled to produce water from the Edwards Aquifer in the shared territory described by Subsection (a).

(c) The district has jurisdiction over groundwater and any well that is drilled to produce water from any aquifer other than the Edwards Aquifer in the shared territory described by Subsection (a).

(d) Except for the district and the Edwards Aquifer Authority, no district or authority created under Section 52, Article III, or Section 59, Article XVI, Texas Constitution, has authority in the shared territory described by Subsection (a) to regulate the spacing of water wells or the production from water wells.

(e) The district has jurisdiction over any well that is drilled to produce water from the Edwards Aquifer or any other aquifer in the territory described by Section 8802.003.

(f) The district's jurisdiction over any well that is drilled to produce water in the territory described in Section 8802.003, including a well that is used to recover water that has been injected as part of an aquifer storage and recovery project, applies to all wells for which the district has jurisdiction in the shared territory described by this section.

SECTION 2. Section 8802.1045, Special District Local Laws Code, is amended by adding Subsection (g) to read as follows:

(g) This subsection applies only to a well located in the shared territory described by Section 8802.0035. Notwithstanding Subsection (b), the district may not charge an annual production fee of more than 17 cents per thousand gallons of water authorized to be produced under a permit from a well under this subsection, if the water is permitted for any use other than agricultural use.

SECTION 3. As soon as practicable after the effective date of this Act, and in conformance with the requirements of Section 8802.053, Special District Local Laws Code, the board of directors of the Barton Springs-Edwards Aquifer Conservation District shall

revise the single-member districts as the board considers appropriate to reflect the changes in territory made by Section 8802.0035, Special District Local Laws Code, as added by this Act.

SECTION 4. (a) In this section:

(1) "District" means the Barton Springs-Edwards Aquifer Conservation District.

(2) "Maximum production capacity" means the maximum production capacity of a well, which may be based on a 36-hour pump test conducted at the time the well was initially constructed or placed into service.

(b) This section applies only to the shared territory added to the district by Section 8802.0035, Special District Local Laws Code, as added by this Act.

(c) A person operating a well before the effective date of this Act or who has entered into a contract before the effective date of this Act to drill or operate a well that is or will be located in the territory described by Subsection (b) of this section and subject to the jurisdiction of the district under Section 8802.0035, Special District Local Laws Code, as added by this Act, shall file an administratively complete permit application with the district not later than three months after the effective date of this Act for the drilling, equipping, completion, or operation of any well if the well requires a permit under the rules or orders of the district. The person may file the permit application for an amount of groundwater production not to exceed the maximum production capacity of the well.

(d) The district shall issue a temporary permit to a person

who files an application under Subsection (c) of this section without a hearing on the application not later than the 30th day after the date of receipt of the application. The district shall issue the temporary permit for the groundwater production amount set forth in the application. The temporary permit issued under this subsection shall provide the person with retroactive and prospective authorization to drill, operate, or perform another activity related to a well for which a permit is required by the district for the period of time between the effective date of this Act and the date that the district takes a final, appealable action on issuance of a regular permit pursuant to the permit application if:

(1) the person's drilling, operating, or other activities associated with the well are consistent with the authorization sought in the permit application;

(2) the person timely pays to the district all administrative fees and fees related to the amount of groundwater authorized to be produced pursuant to the temporary permit in the same manner as other permit holders in the district; and

(3) the person complies with other rules and orders of the district applicable to permit holders.

(e) The temporary permit issued under Subsection (d) does not confer any rights or privileges to the permit holder other than those set forth in this section. After issuing the temporary permit, the district shall process the permit application for notice, hearing, and consideration for issuance of a regular permit consistent with this section. The district, after notice and

hearing, shall issue an order granting the regular permit authorizing groundwater production in the amount set forth in the temporary permit unless the district finds that authorizing groundwater production in the amount set forth in the temporary permit will cause:

(1) a failure to achieve the applicable adopted desired future conditions for the aquifer; or

(2) an unreasonable impact on existing wells.

(f) In the hearing on issuance of the regular permit under Subsection (e), the permit applicant bears the burden of proof.

(g) The holder of a temporary or regular permit subject to a district order under this section to reduce the amount of groundwater production from the permitted well may contest the reduction by requesting a contested case hearing to be conducted by the State Office of Administrative Hearings in the manner provided by Sections 36.416, 36.4165, and 36.418, Water Code. The district shall contract with the State Office of Administrative Hearings to conduct the hearing as provided by those sections of the Water Code. To the extent possible, the State Office of Administrative Hearings shall expedite a hearing under this subsection. The permit applicant bears the burden of proof in the hearing.

(h) For the State Office of Administrative Hearings to recommend overturning a district order reducing the amount of groundwater authorized to be produced under a temporary permit, the permit holder must demonstrate by a preponderance of the evidence that the production of the amount of groundwater authorized based on the maximum production capacity will not cause:

(1) a failure to achieve applicable adopted desired future conditions for the aquifer; or

(2) an unreasonable impact on existing wells as found in the district's order.

(i) A person who relies on the temporary permit granted by this section to drill, operate, or engage in other activities associated with a water well assumes the risk that the district may grant or deny, wholly or partly, the permit application when the district takes final action after notice and hearing to issue a regular permit pursuant to the application.

SECTION 5. If the addition of territory under Section 8802.0035, Special District Local Laws Code, as added by this Act, causes the annual water use fee in Section 8802.105 to exceed $1 million, the district shall not require an assessment of greater than $1 million annually as adjusted to reflect the percentage change during the preceding year in the Consumer Price Index.

SECTION 6. (a) The legislature validates and confirms all acts and proceedings of the board of directors of the Barton Springs-Edwards Aquifer Conservation District that were taken before the effective date of this Act.

(b) Subsection (a) of this section does not apply to any matter that on the effective date of this Act:

(1) is involved in litigation if the litigation ultimately results in the matter being held invalid by a final judgment of a court; or

(2) has been held invalid by a final judgment of a court.

SECTION 7. (a) The legal notice of the intention to introduce this Act, setting forth the general substance of this Act, has been published as provided by law, and the notice and a copy of this Act have been furnished to all persons, agencies, officials, or entities to which they are required to be furnished under Section 59, Article XVI, Texas Constitution, and Chapter 313, Government Code.

(b) The governor, one of the required recipients, has submitted the notice and Act to the Texas Commission on Environmental Quality.

(c) The Texas Commission on Environmental Quality has filed its recommendations relating to this Act with the governor, the lieutenant governor, and the speaker of the house of representatives within the required time.

(d) All requirements of the constitution and laws of this state and the rules and procedures of the legislature with respect to the notice, introduction, and passage of this Act are fulfilled and accomplished.

SECTION 8. It is the intent of the legislature that this Act apply only to the territory described by Section 8802.0035, Special District Local Laws Code, as added by this Act, and not have statewide implications.

SECTION 9. This Act takes effect immediately if it receives a vote of two-thirds of all the members elected to each house, as provided by Section 39, Article III, Texas Constitution. If this Act does not receive the vote necessary for immediate effect, this Act takes effect September 1, 2015.

President of the Senate

Speaker of the House

I certify that H.B. No. 3405 was passed by the House on May 8, 2015, by the following vote: Yeas 126, Nays 15, 1 present, not voting; that the House refused to concur in Senate amendments to H.B. No. 3405 on May 29, 2015, and requested the appointment of a conference committee to consider the differences between the two houses; that the House adopted the conference committee report on H.B. No. 3405 on May 31, 2015, by the following vote: Yeas 143, Nays 1, 1 present, not voting, and that the House adopted H.C.R. No. 149 authorizing certain corrections in H.B. No. 3405 on June 1, 2015, by the following vote: Yeas 147, Nays 0, 1 present, not voting.

Chief Clerk of the House

I certify that H.B. No. 3405 was passed by the Senate, with amendments, on May 22, 2015, by the following vote: Yeas 28, Nays 3; at the request of the House, the Senate appointed a conference committee to consider the differences between the two houses; that the Senate adopted the conference committee report on H.B. No. 3405 on May 30, 2015, by the following vote: Yeas 27, Nays 4, and that the Senate adopted H.C.R. No. 149 authorizing certain corrections in H.B. No. 3405 on June 1, 2015, by the following vote: Yeas 31, Nays 0.

_____

Secretary of the Senate

APPROVED: _____

Date

_____

Governor

Appendix D

Geophysical Logs

GEO CAM

Borehole: TEST WELL D

Logs: GAMMA, CALIPER, RESISITIVITY

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: NEEDMORE RANCH
Client: DAVENPORT DRILLING
Location: N29* 58' 12.8" W98* 02' 02.5"

Date: 10-23-12
County: HAYS
State: TX

BOREHOLE DATA

Drilling Contractor: DAVENPORT DRILLING
Elevation: 990' GPS
Depth Ref: G.L.

Driller T.D. (ft) : 1000'
Logger T.D. (ft) : 850'
Date Drilled: 10-22-12

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	9 7/8"	0'	1000'	NA		
2						
3						

Drill Method: AIR ROTARY
Hole Medium:
Viscosity:

Weight:
Mud Type:
Rm: at: Deg C

Fluid Level (ft) : 288'
Time Since Circ:

GENERAL DATA

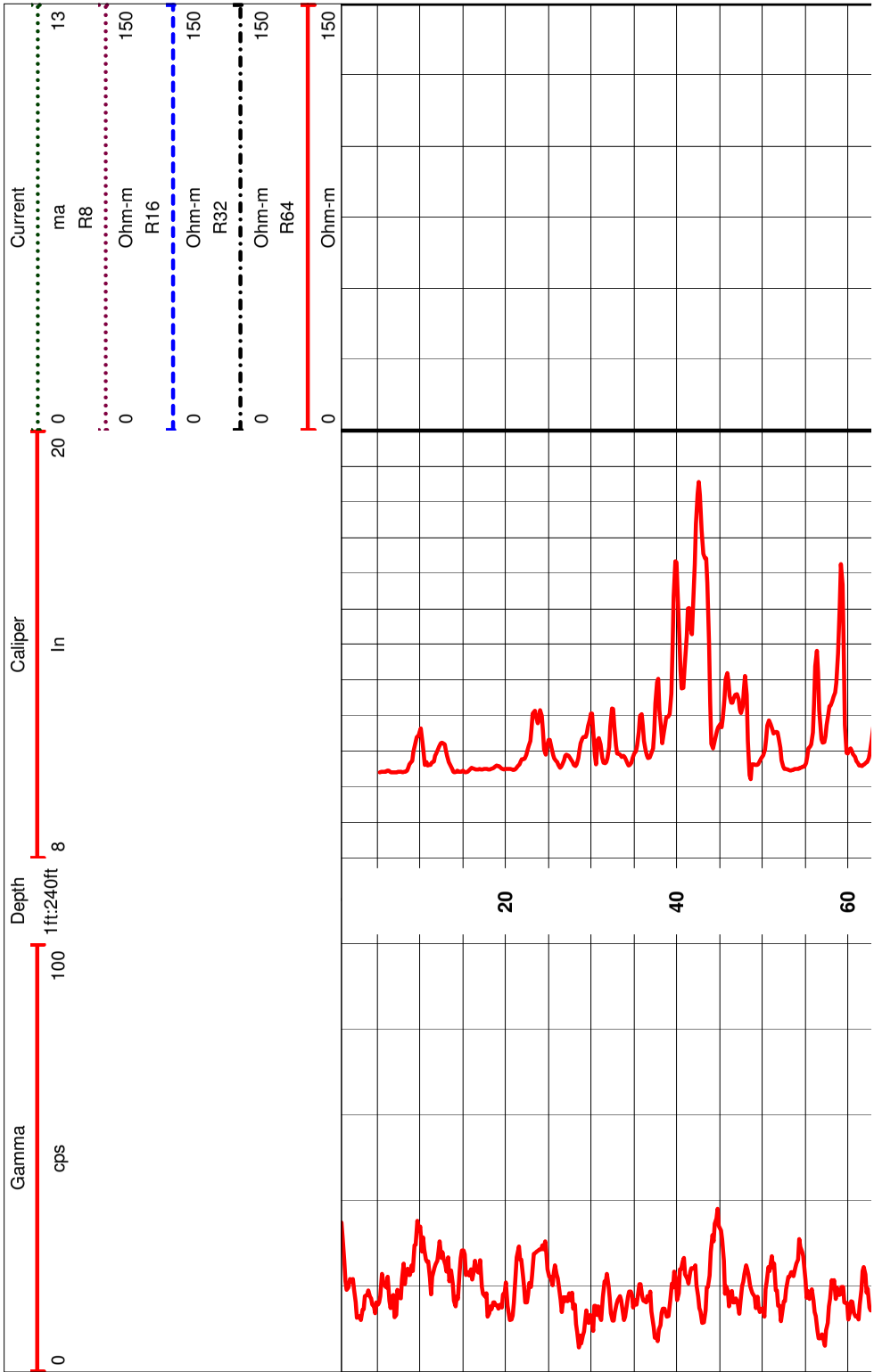
Logged by: Robert Becknal
Witness:

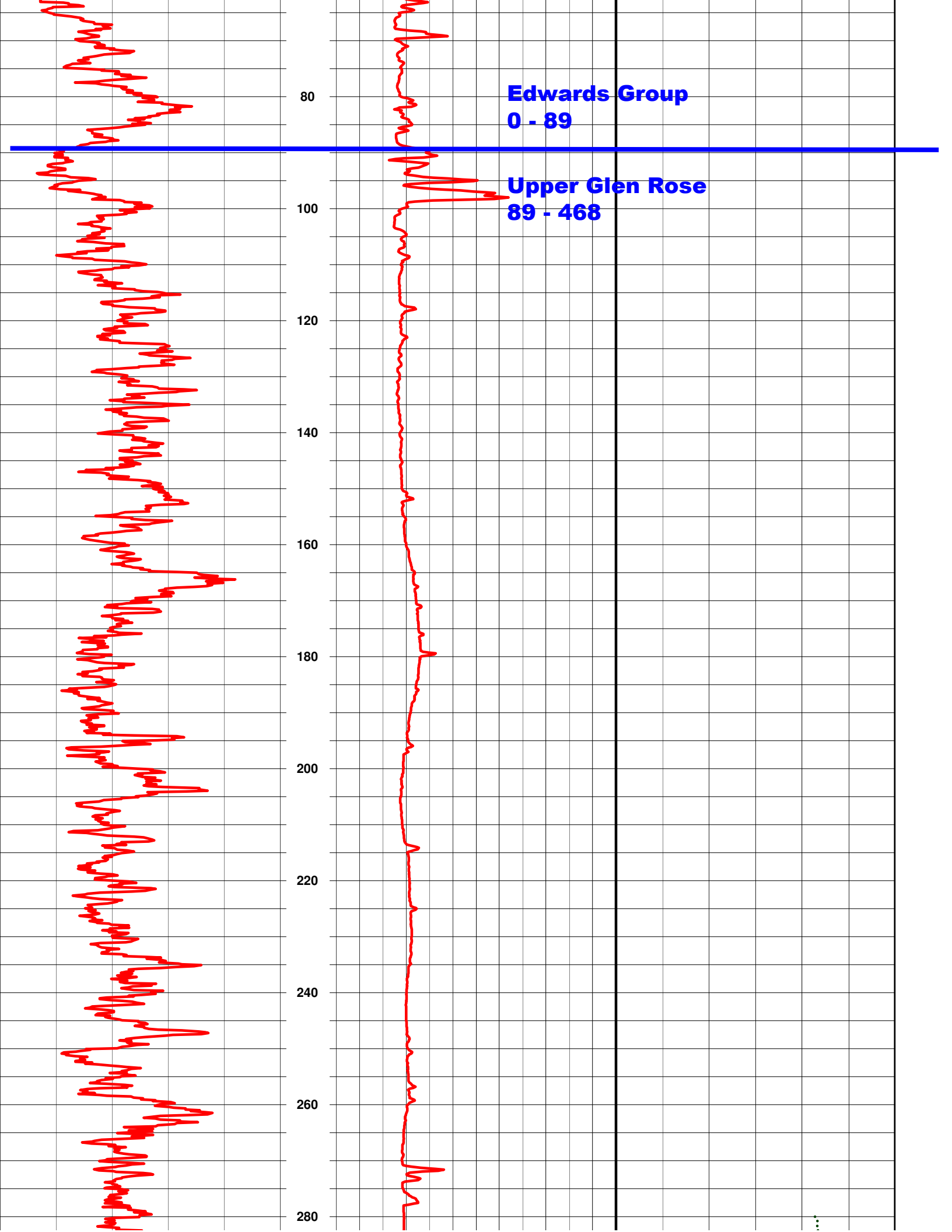
Unit/Truck: 05

LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	2	35	843'	1'	20
CALIPER	2	35'	848'	5'	20
RESISITIVITY	2	35'	290'	850'	20

Comments:

WELL D

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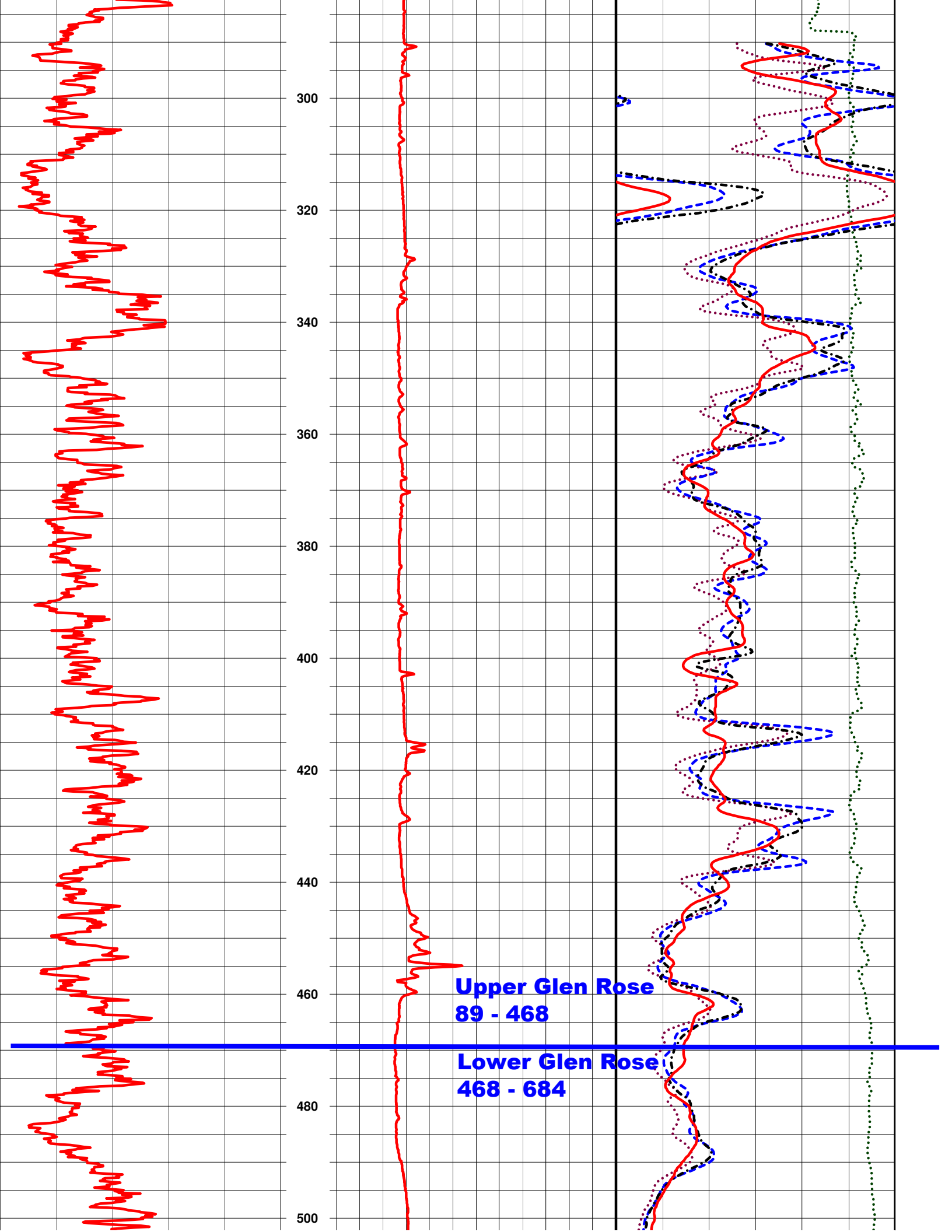
120
140
160
180
200
220
240
260
280
Edwards Group
0 - 89
Upper Glen Rose
89 - 468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320
340
360
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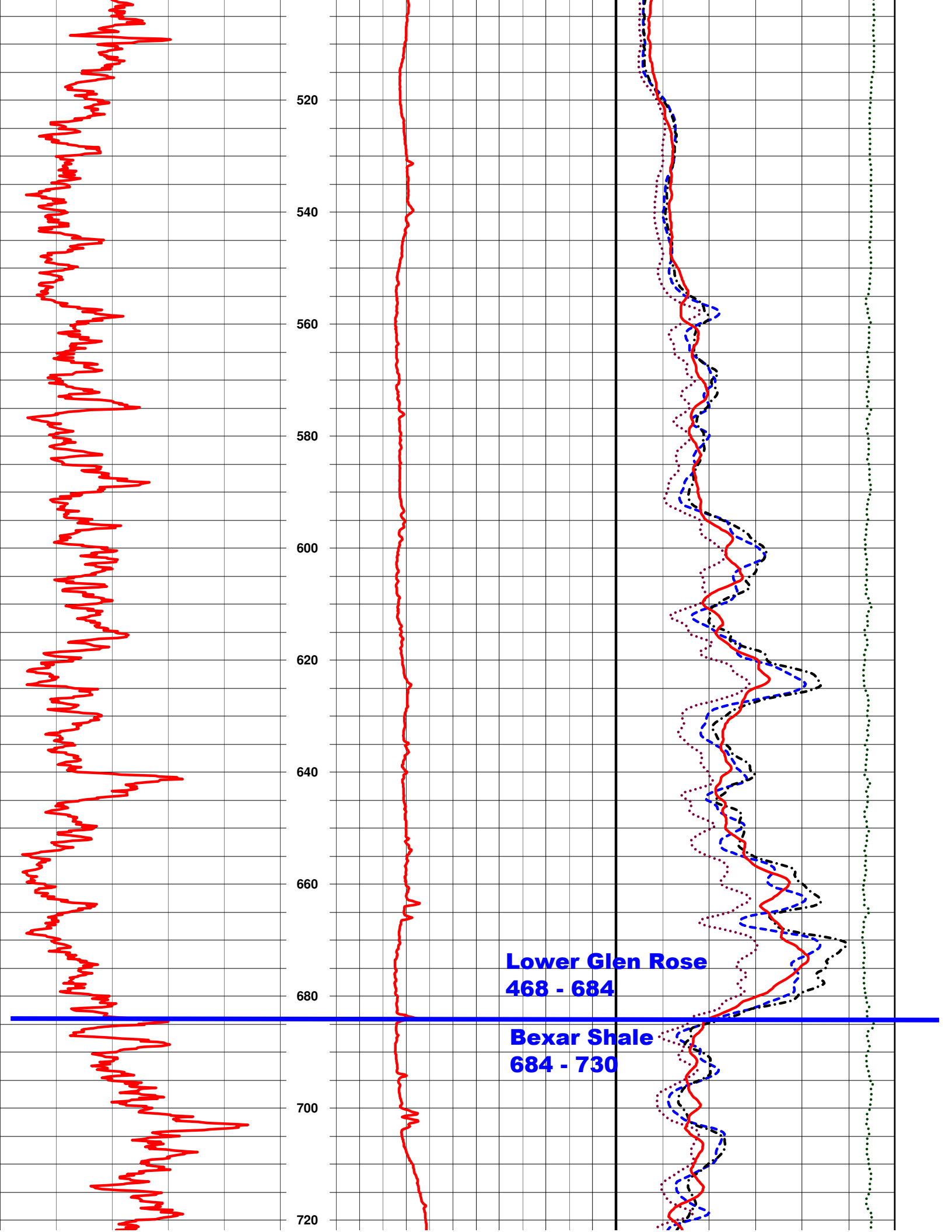
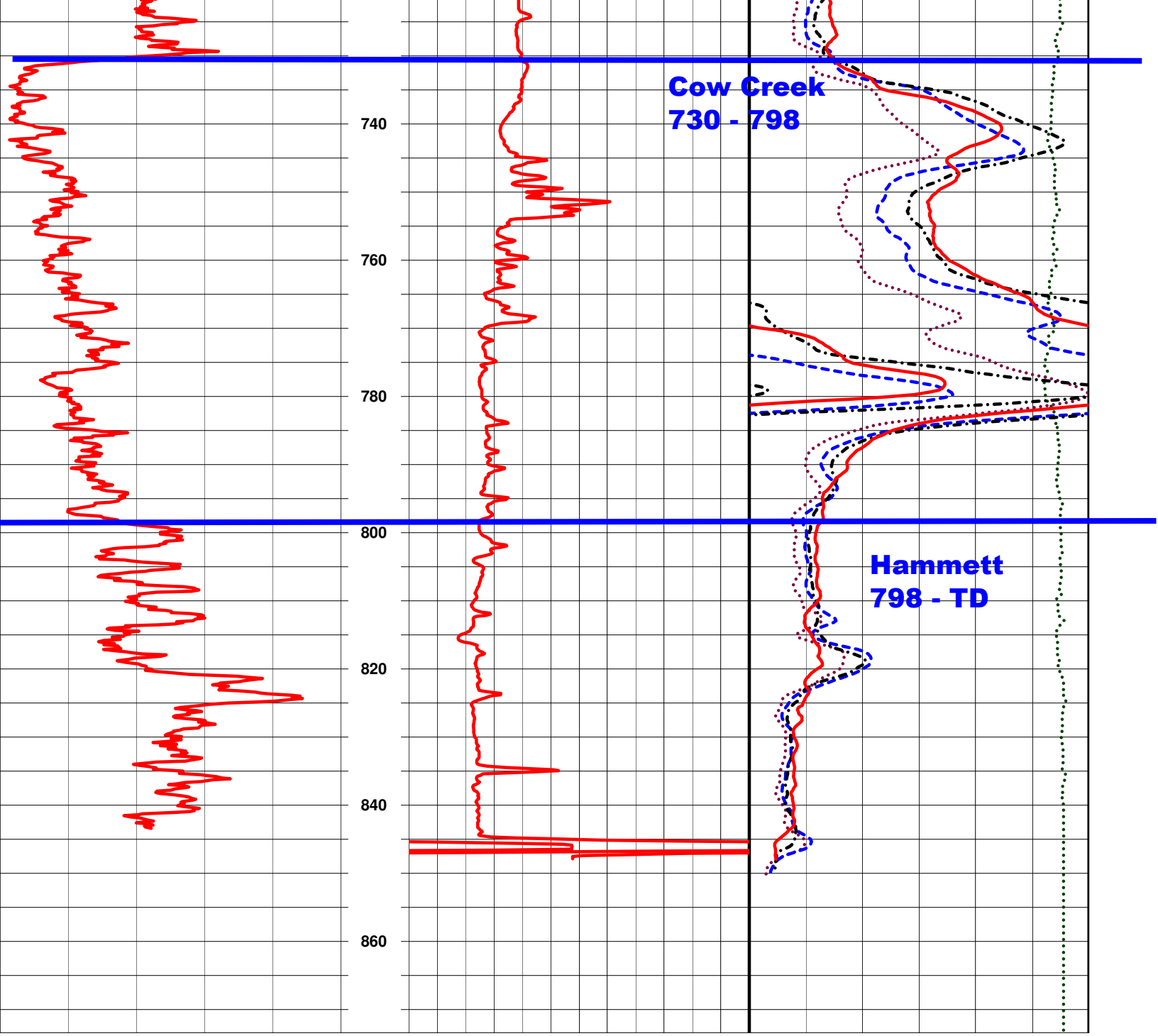
400
420
440
460
480
500
Upper Glen Rose
89 - 468
Lower Glen Rose
468 - 684


520
540
560
580
600
620
640
660
680
700
720
Lower Glen Rose
468 - 684
Bexar Shale
684 - 730


Cow Creek
730 - 798
Hammett
798 - TD
740
760
780
800
820
840
860

GEO CAM

Borehole: NEEDMORE RANCH TOP HILL

Logs: GAMMA, RESISTIVITY,

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: NEEDMORE RANCH TOP HILL
Date: 10-17-2012
Client: **GREG LAMANTIA**
County: HAYS
Location: **N 29* 59' 27.5" W 98* 02' 00"**
State: TX

BOREHOLE DATA

Drilling Contractor: KUTSCHER DRILLING
Driller T.D. (ft) : 1100'
Elevation: 1058' GPS.
Logger T.D. (ft) : 915'
Depth Ref: T.C.
Date Drilled: NA

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	NA			5" PVC	+1.8	879
2						
3						

Drill Method: AIR ROTARY
Weight:
Fluid Level (ft) : 344'
Hole Medium:
Mud Type:
Time Since Circ:
Viscosity:
Rm: at: Deg C

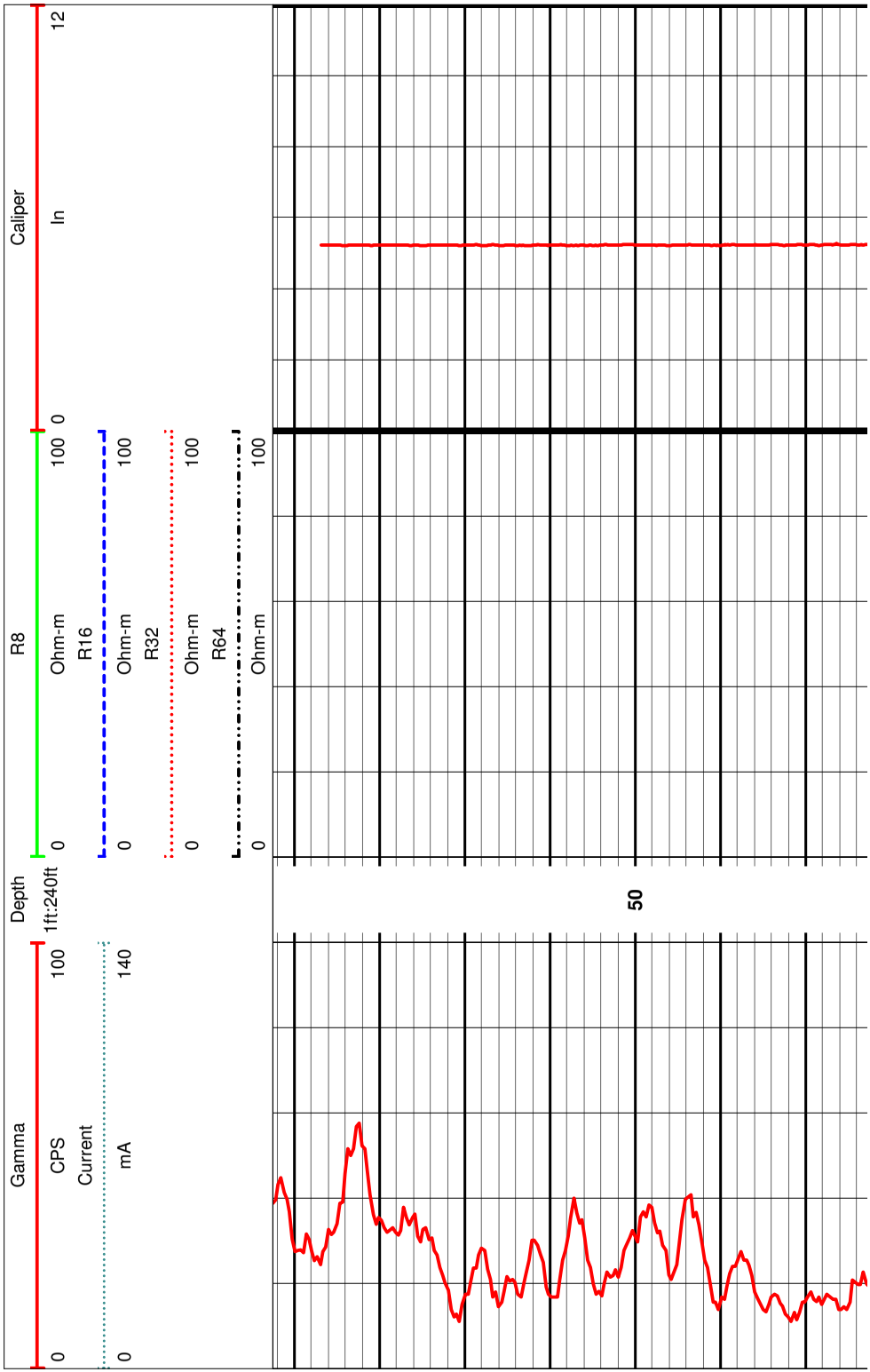
GENERAL DATA

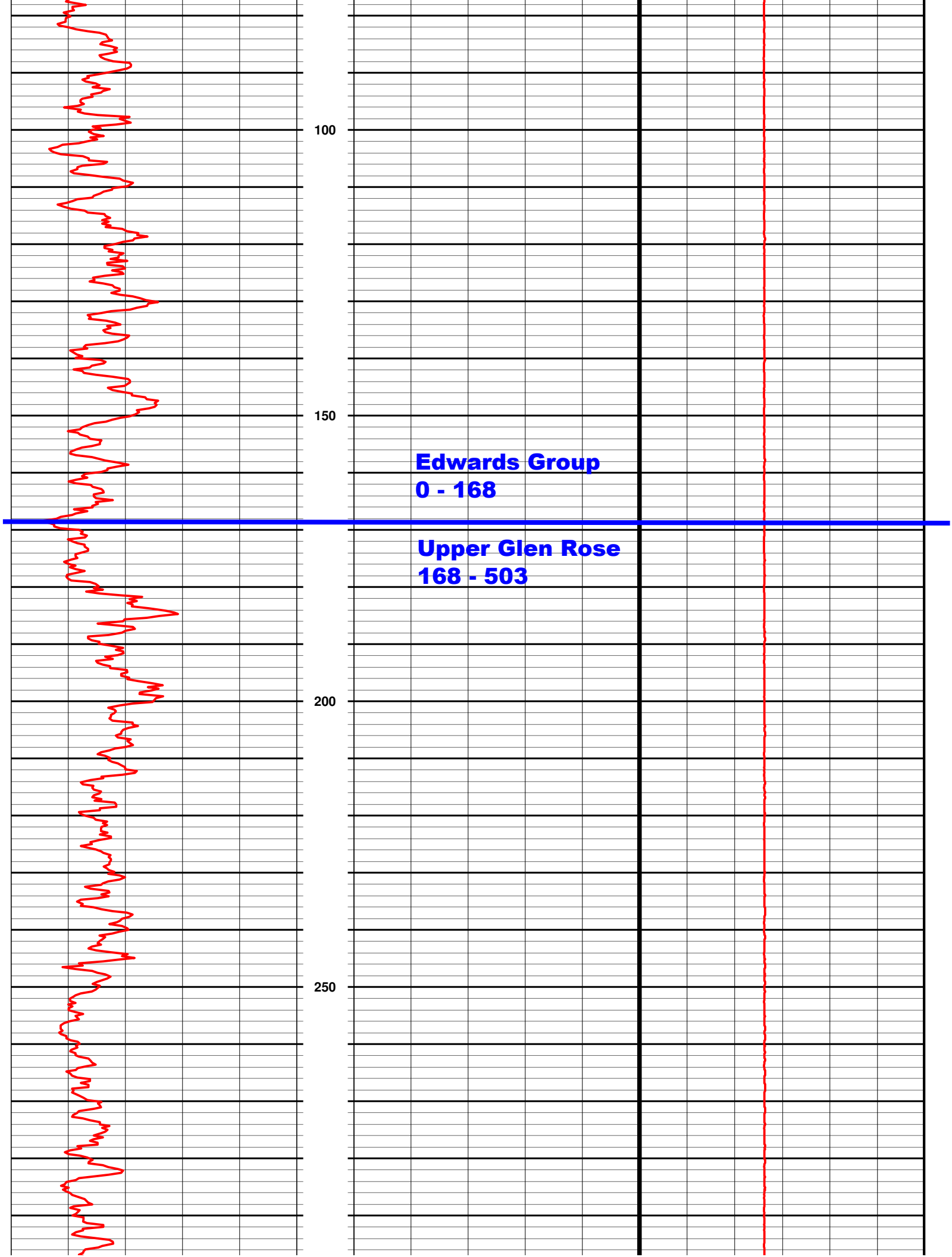
Logged by: ERASMO DE LA FUENTE
Unit/Truck: 08
Witness:

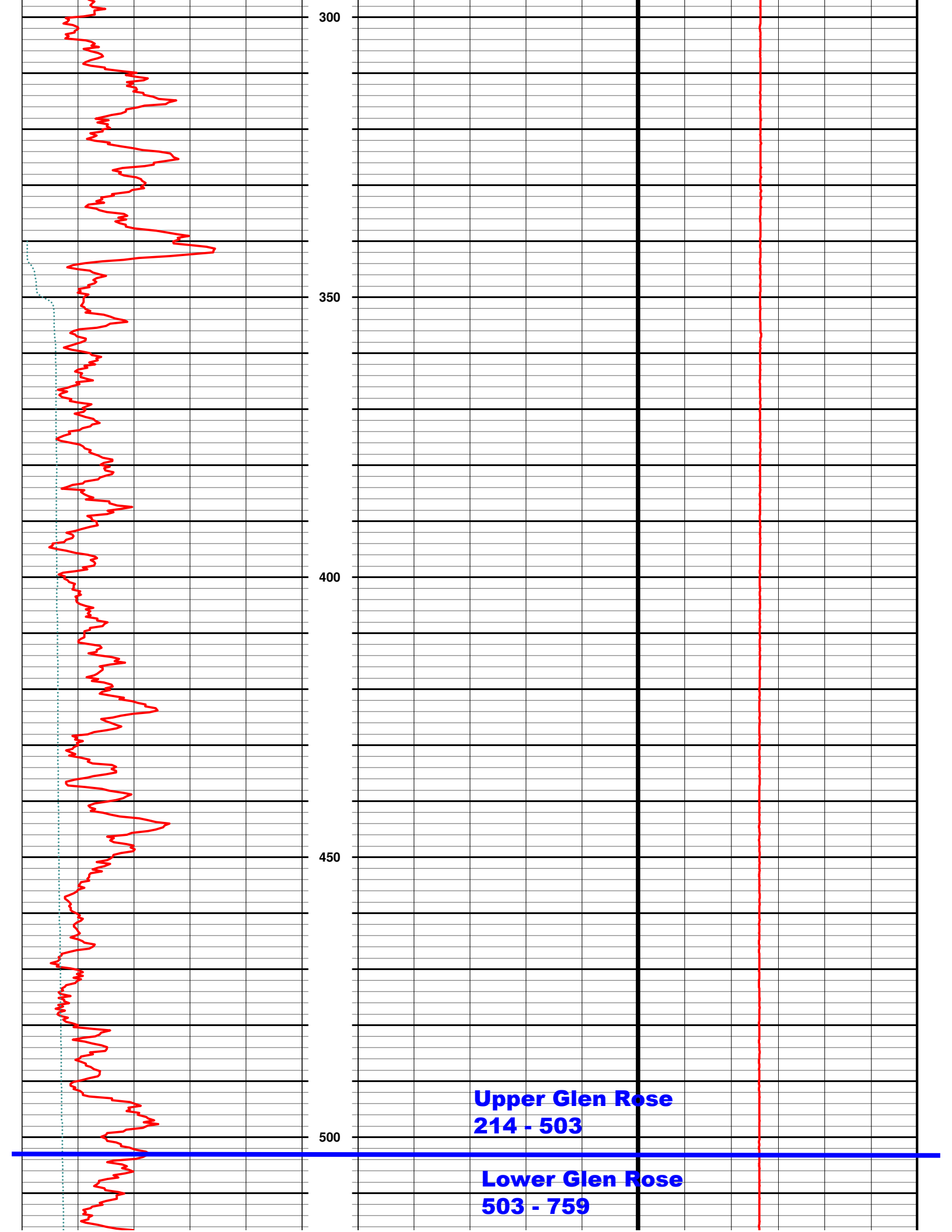
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	2	35	912	8	20
RESISTIVITY	2	35	914	875	20
CALIPER	2	35	915	13	

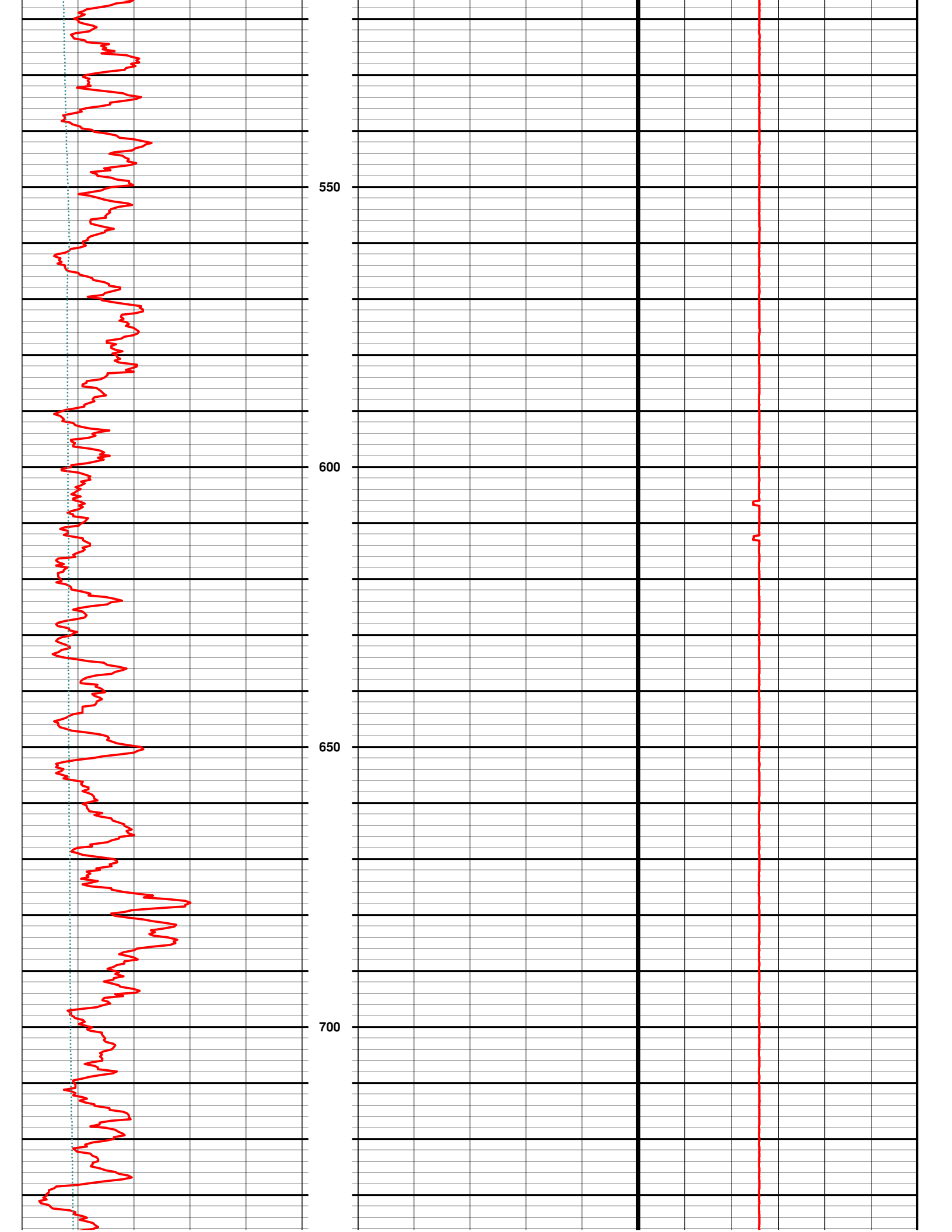
Comments:

TOP OF THE HILL WELL




100
150
Edwards Group
0 - 168
Upper Glen Rose
168 - 503
200
250


300
350
400
450
500
Upper Glen Rose
214 - 503
Lower Glen Rose
503 - 759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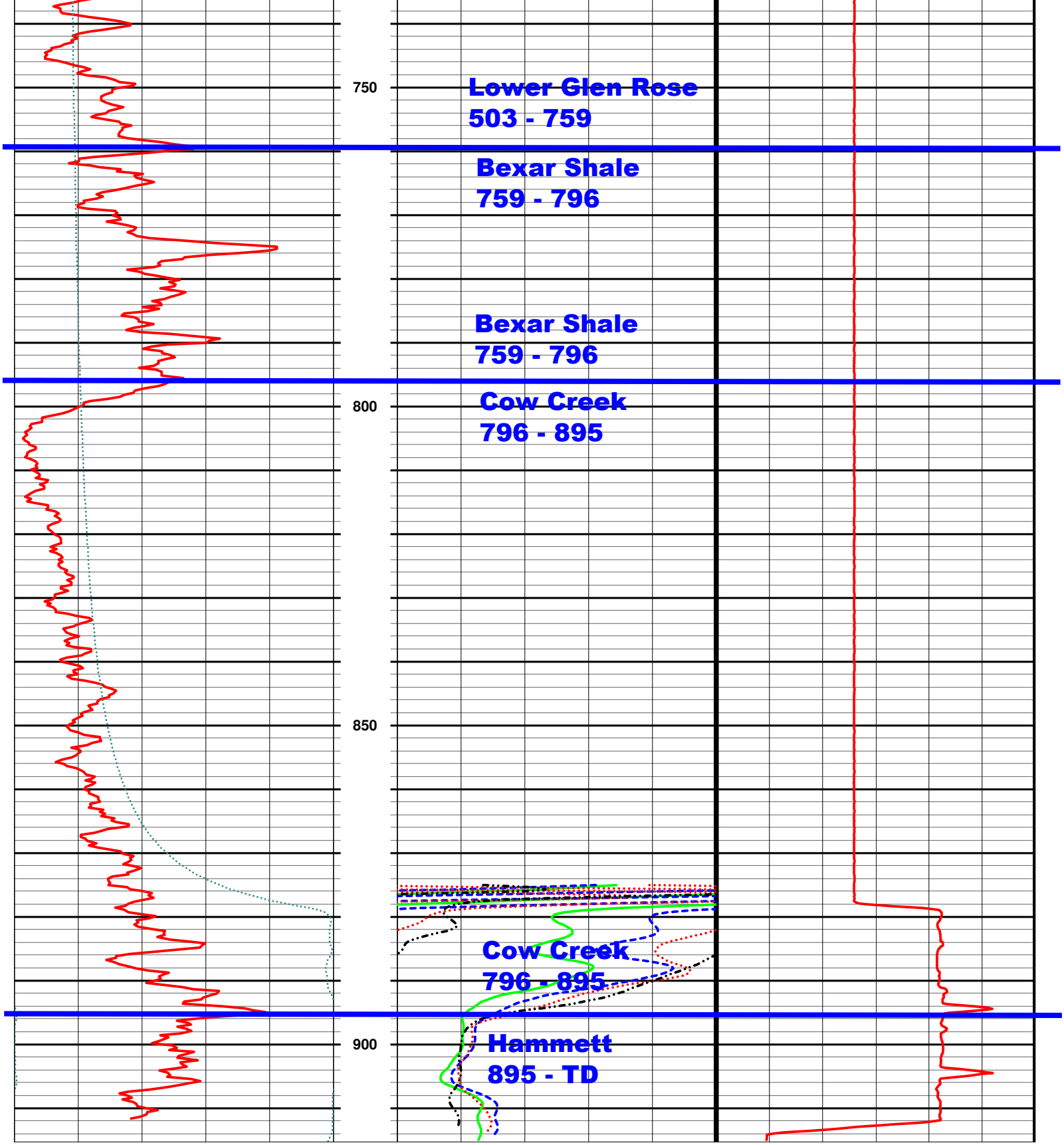
600
650
700


750
800
850
900
Lower Glen Rose
503 - 759
Bexar Shale
759 - 796
Bexar Shale
759 - 796
Cow Creek
796 - 895
Cow Creek
796 - 895
Hammett
895 - TD

GEO CAM

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Borehole: NEEDMORE RANCH POND

Logs: GAMMA, RESISTIVITY CALIPER

Project: NEEDMORE RANCH POND

Client: GREG LAMANTIA

Location: N 29* 58' 12.7" W 98* 03' 07.9"

Date: 10-17-2012

County: HAYS

State: TX

BOREHOLE DATA

Drilling Contractor: NA

Elevation: 1098' GPS.

Depth Ref: T.C.

Driller T.D. (ft) : NA

Logger T.D. (ft) : 810'

Date Drilled: NA

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	NA			6" STEEL	+1.5	NA
2						
3						

Drill Method: NA

Weight:

Fluid Level (ft) : 426

Hole Medium:

Mud Type:

Time Since Circ:

Viscosity:

Rm: at: Deg C

GENERAL DATA

Logged by: ERASMO DE LA FUENTE

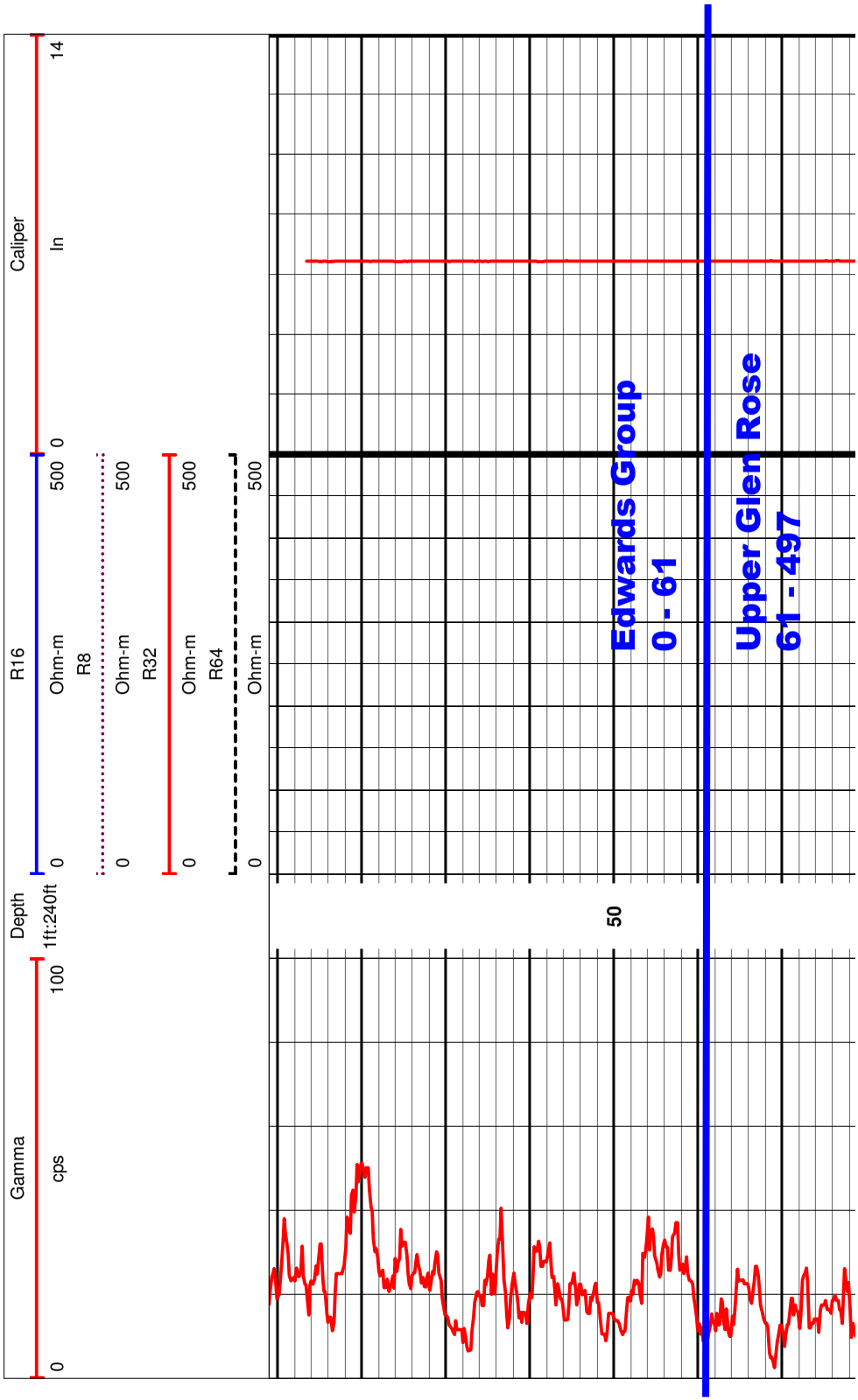
Unit/Truck: 08

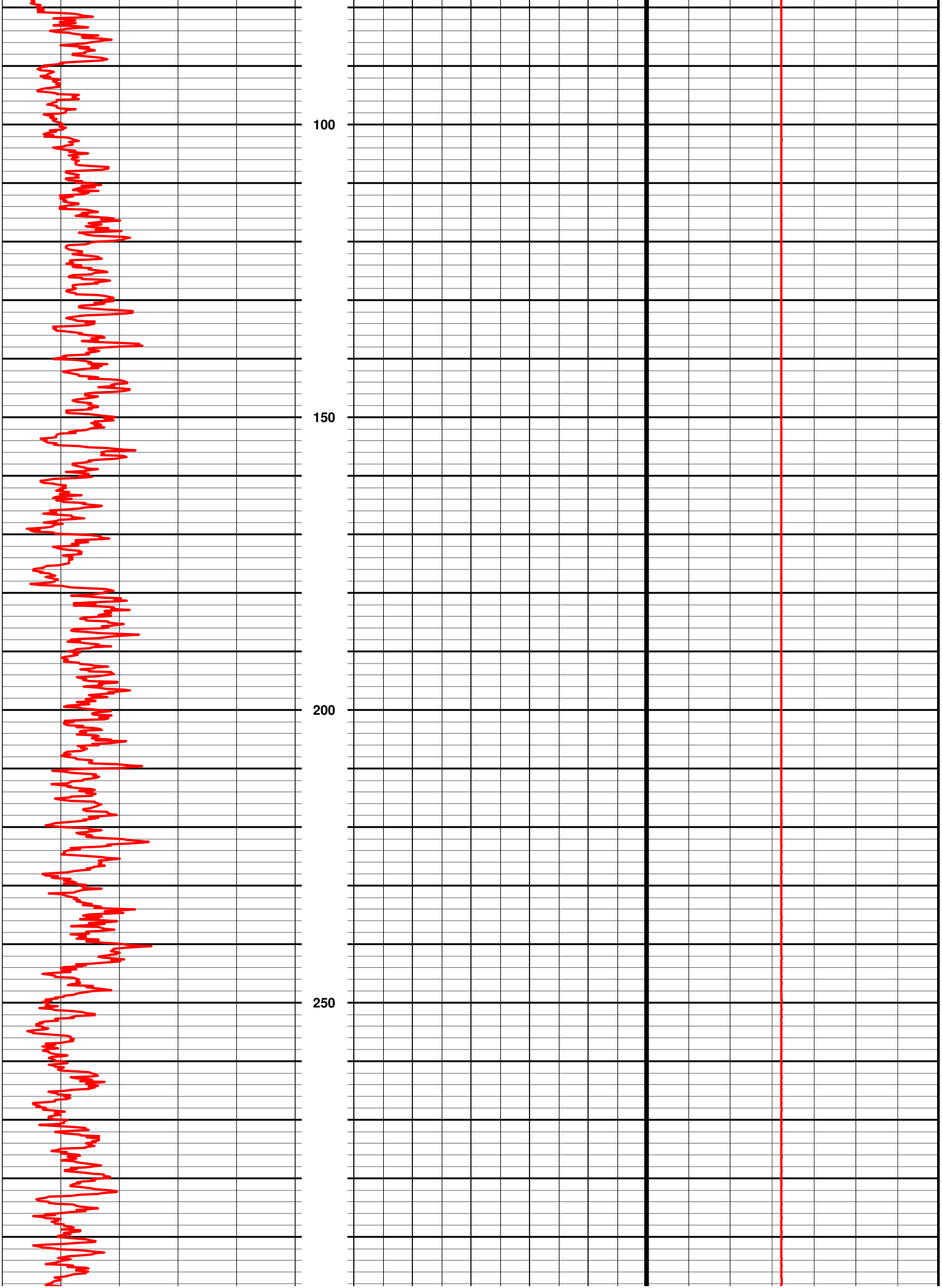
Witness:

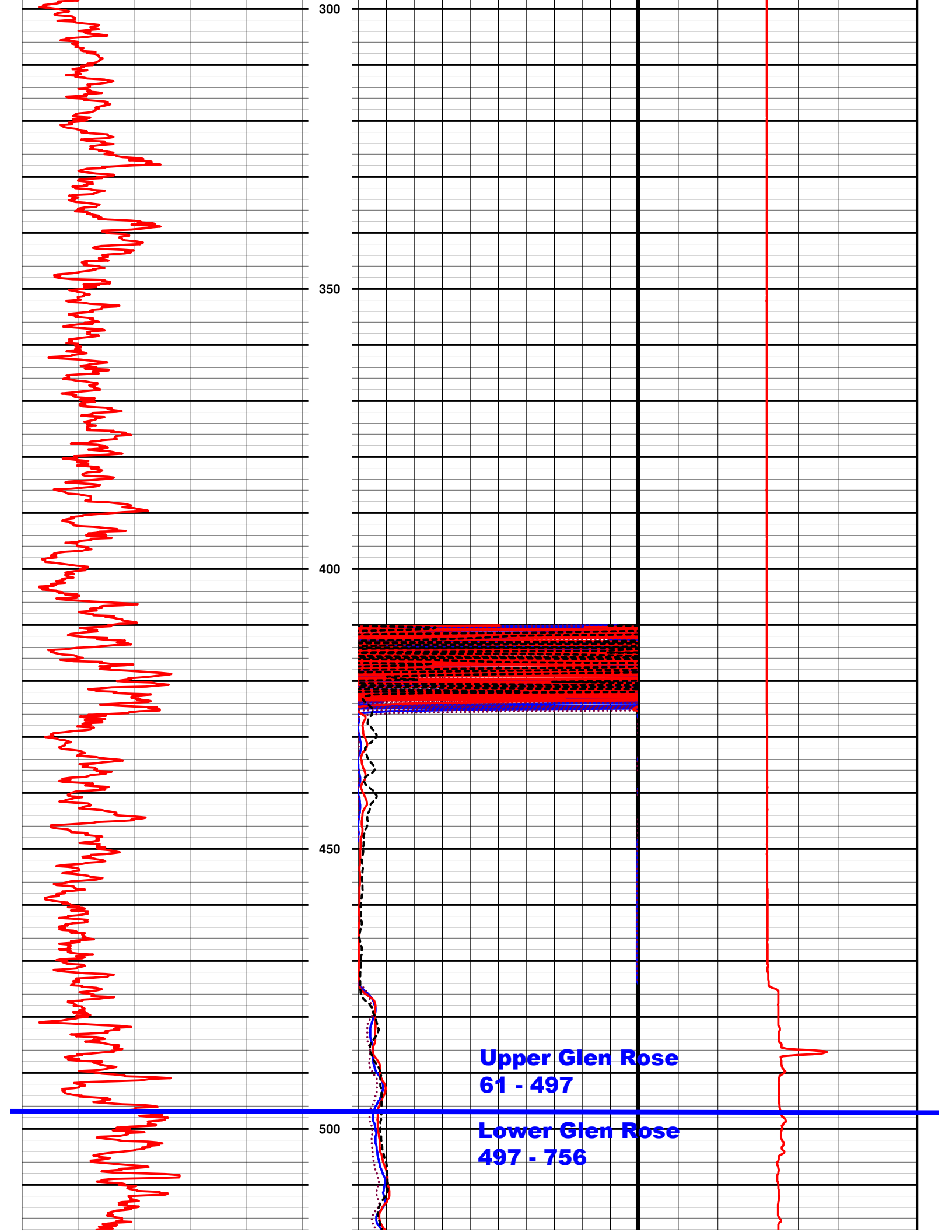
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	2	35	805	9	20
RESISITIVITY	2	35	810	410	20
CALIPER	2	35	810	14	20

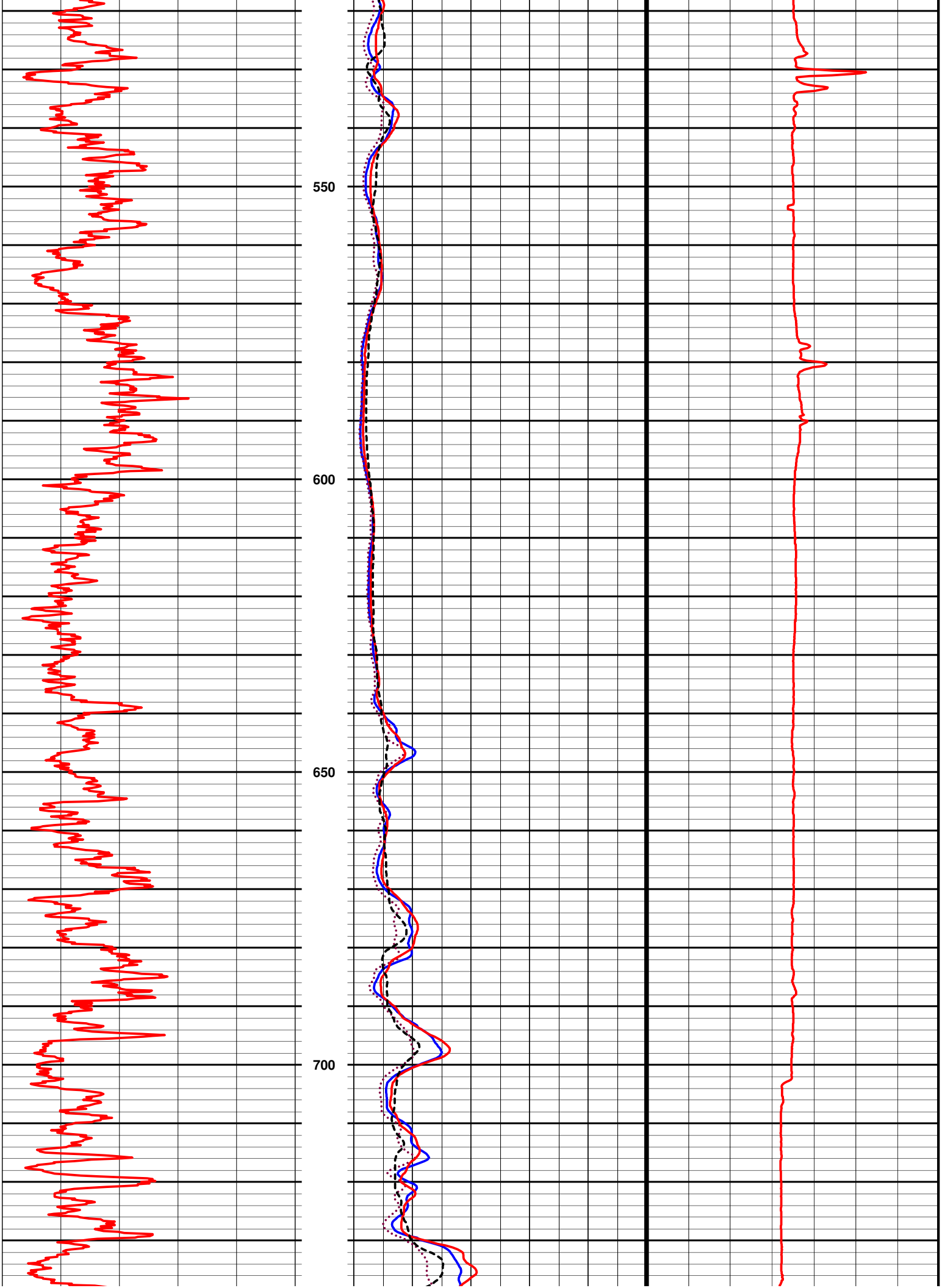
Comments:

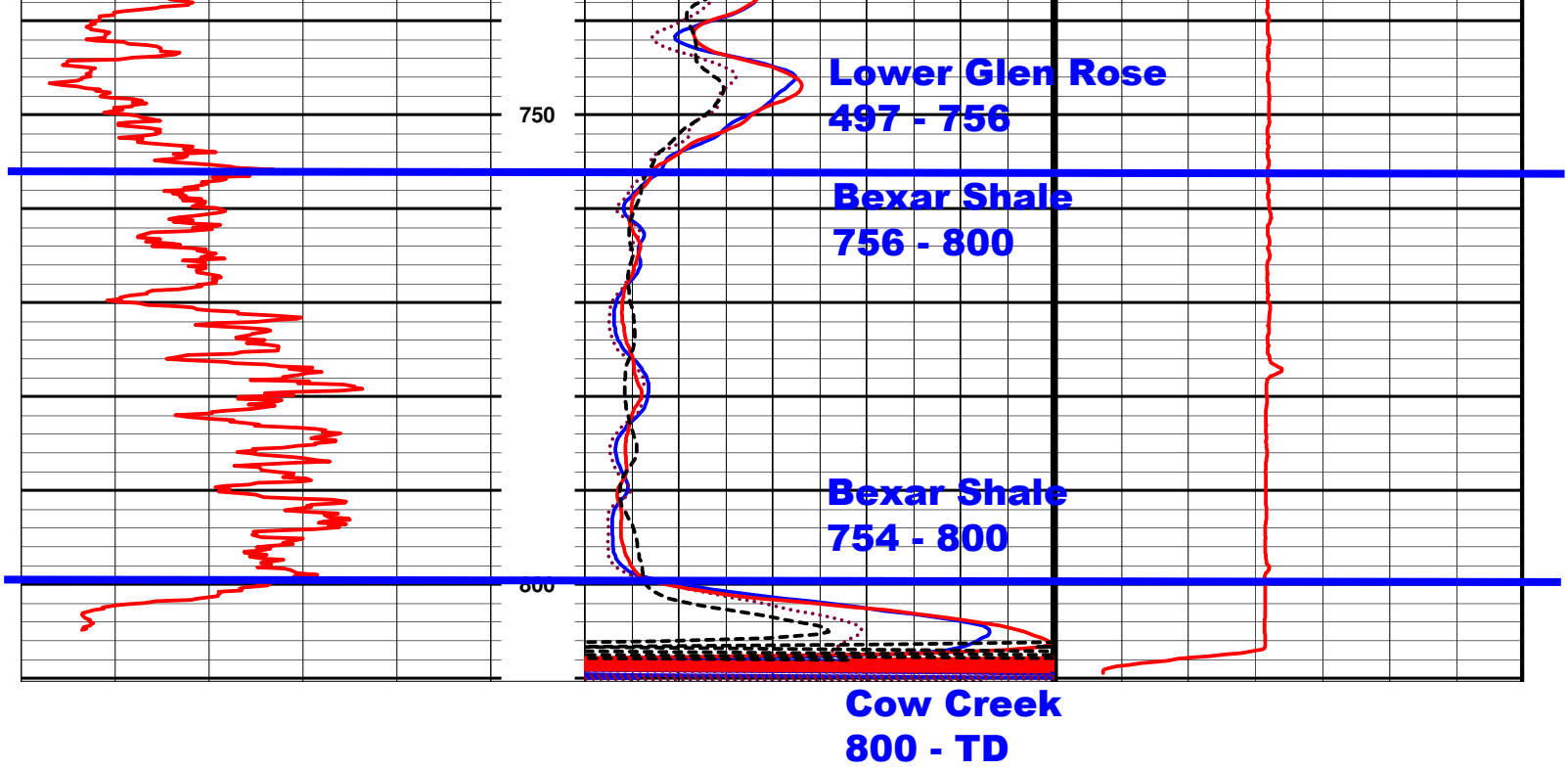
CATFISH POND WELL




100
150
200
250


300
350
400
450
500
Upper Glen Rose
61 - 497
Lower Glen Rose
497 - 756


550
600
650
700


750
800
Lower Glen Rose
497 - 756
Bexar Shale
756 - 800
Bexar Shale
754 - 800
Cow Creek
800 - TD

GEO CAM

Borehole: NEEDMORE RANCH TW A

Logs: GAMMA, CALIPER, SPR

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: NEEDMORE RANCH TEST WELL A
Date: 12-19-11
Client: DAVENPORT DRILLING
County: HAYS
Location: N29* 56' 52.9'' W98* 02' 19.6''
State: TX

BOREHOLE DATA

Drilling Contractor: DAVENPORT DRILLING
Driller T.D. (ft) : 1060'
Elevation: 840' GPS
Logger T.D. (ft) : 1037'
Depth Ref: G.L.
Date Drilled: 12-19-11

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	8 3/4''	0	TD	NA		
2						
3						

Drill Method: AIR ROTARY
Weight:
Fluid Level (ft) : 214'
Hole Medium:
Mud Type:
Time Since Circ:
Viscosity:
Rm: at: Deg C

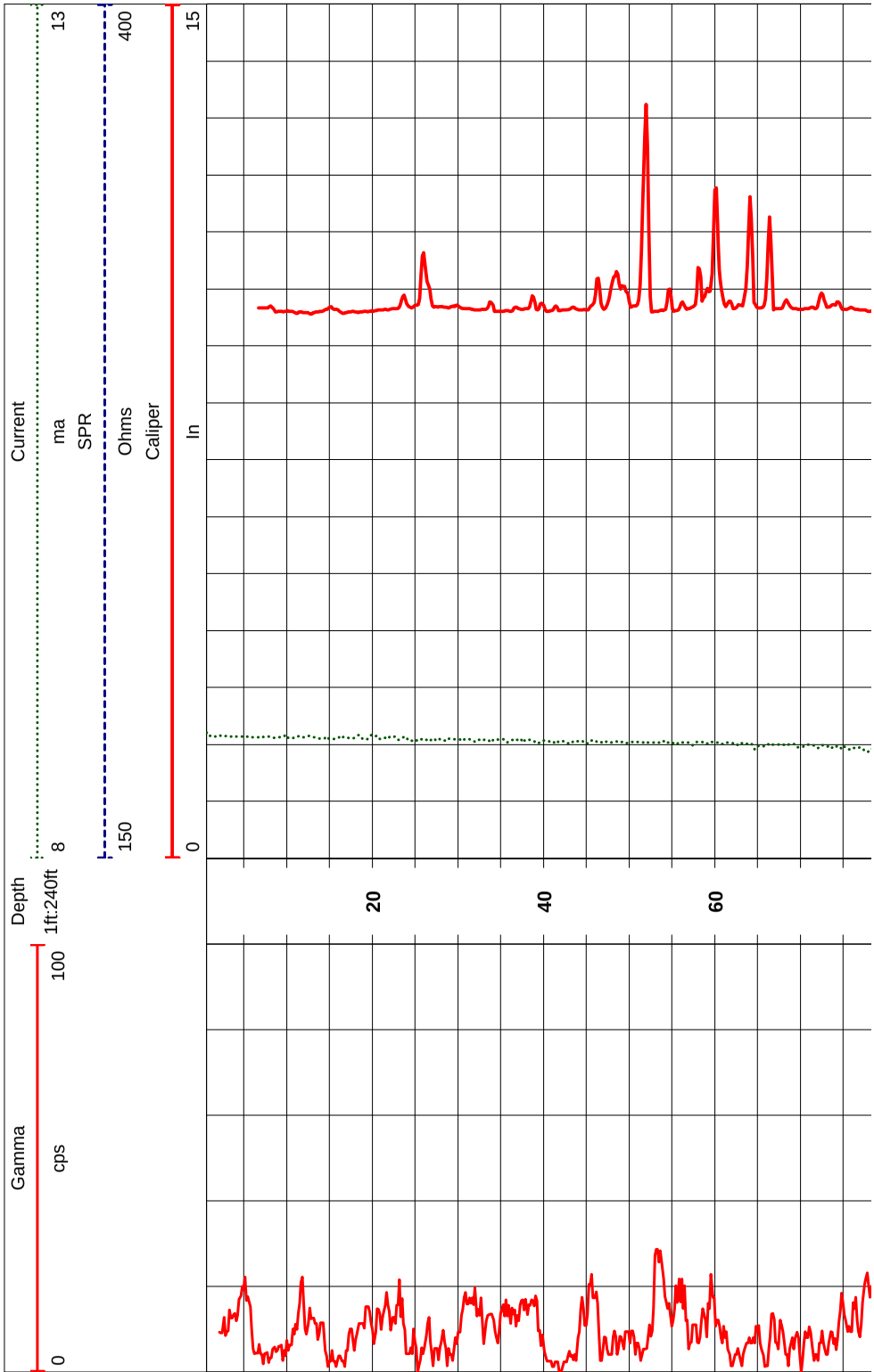
GENERAL DATA

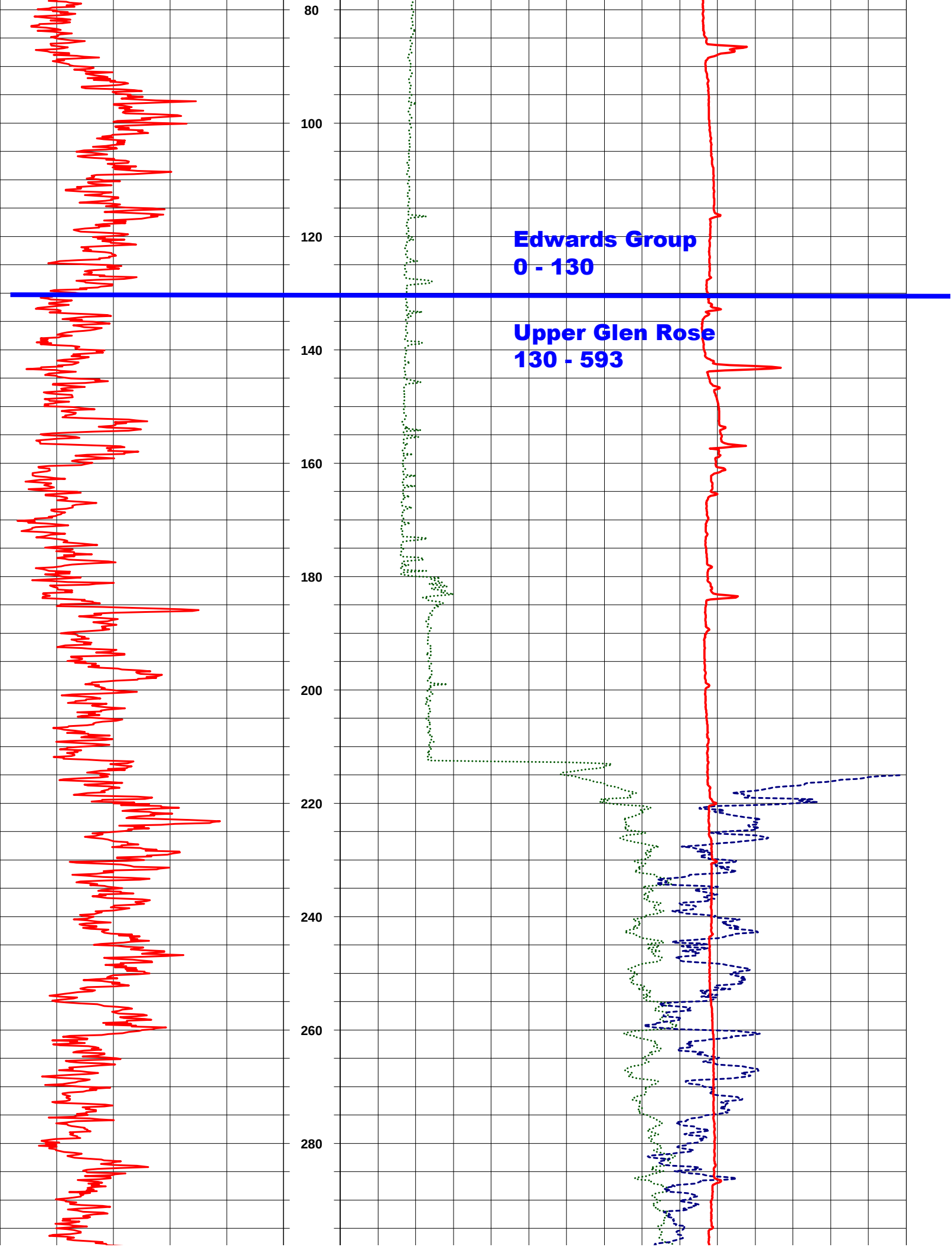
Logged by: Robert Becknal
Unit/Truck: 05
Witness:

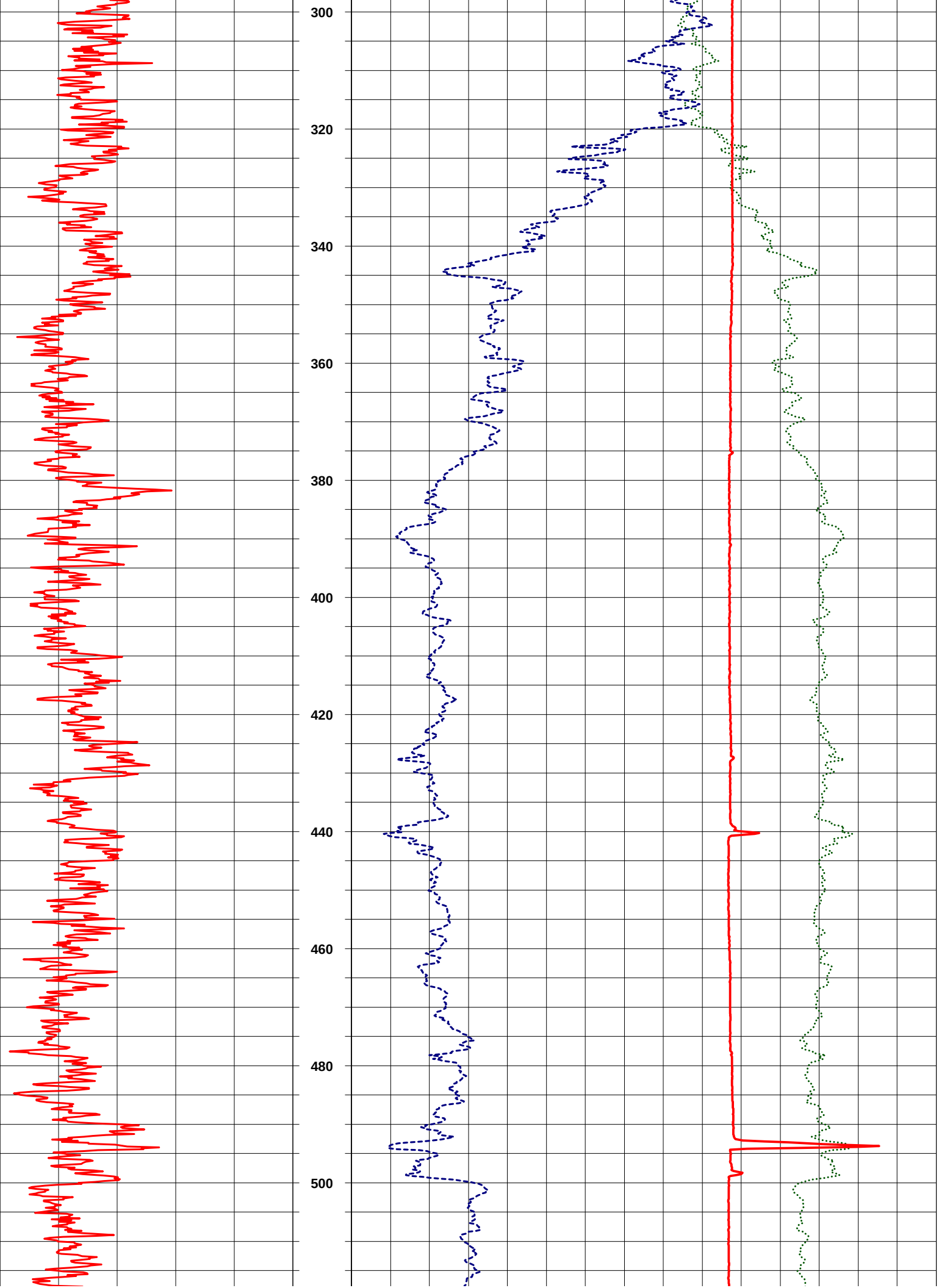
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	2	25	1032'	2'	20
CALIPER	2	25	1037'	7'	20
SPR	1	30	215'	1035'	20

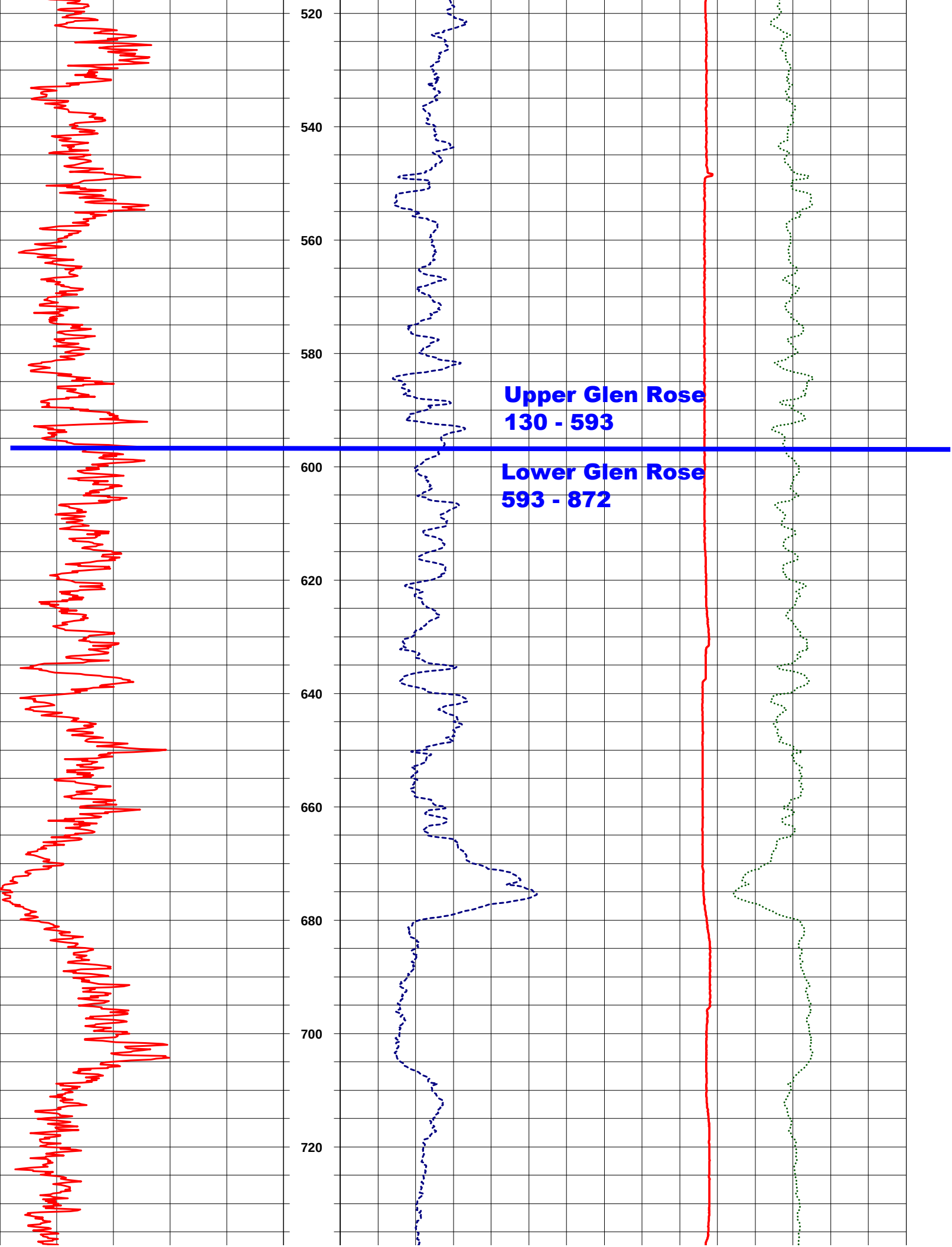
Comments:

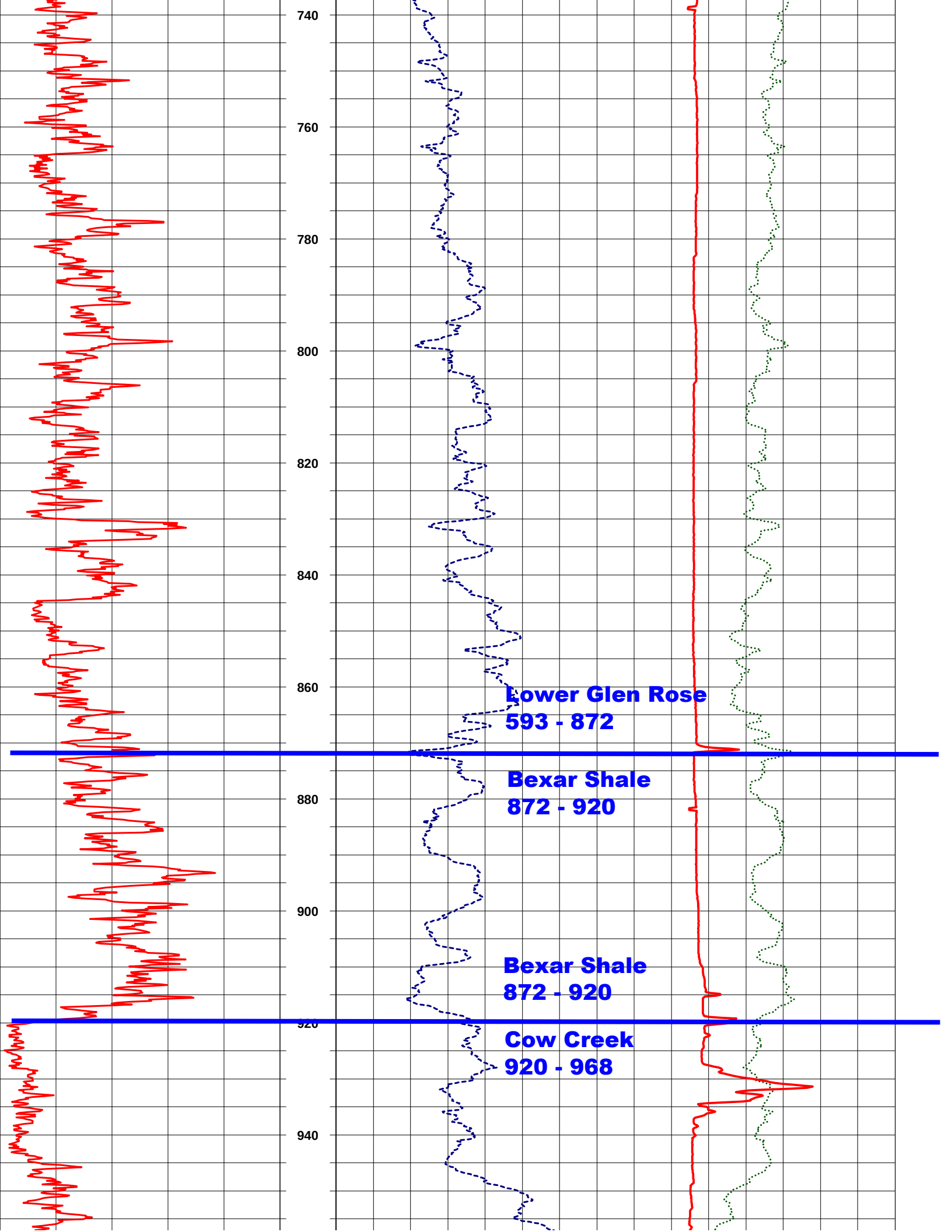
TEST WELL A

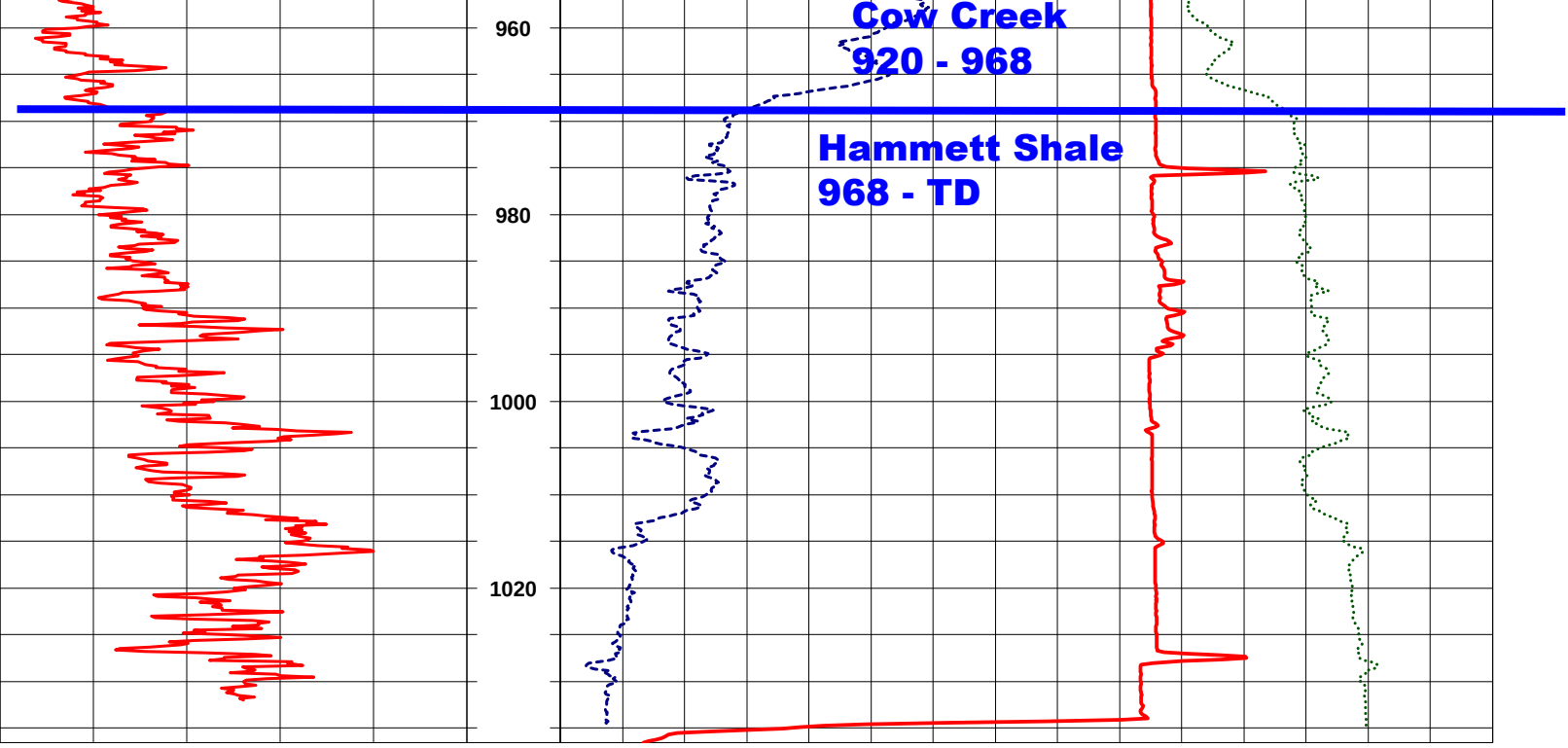



80
100
120
140
160
180
200
220
240
260
280
Edwards Group
0 - 130
Upper Glen Rose
130 - 593


300
320
340
360
380
400
420
440
460
480
500


520
540
560
580
600
620
640
660
680
700
720
Upper Glen Rose
130 - 593
Lower Glen Rose
593 - 872


740
760
780
800
820
840
860
880
900
920
940
Lower Glen Rose
593 - 872
Bexar Shale
872 - 920
Bexar Shale
872 - 920
Cow Creek
920 - 968


960
980
1000
1020
Cow Creek
920 - 968
Hammett Shale
968 - TD

GEO CAM

Borehole: WELL NO. B

Logs: GAMMA, RESISTIVITY, SP

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: NEEDMOORE RIVER RANCH WELL B
Date: 08-08-11
Client: DAVENPORT DRILLING & PUMP SER.
County: COMAL
Location: N 29* 57' 15.4" W 98* 01' 59.3"
State: TX

BOREHOLE DATA

Drilling Contractor: DAVENPORT
Driller T.D. (ft) : 1100'
Elevation: 981' GPS
Logger T.D. (ft) : 1070'
Depth Ref: G.L.
Date Drilled: 08-08-11

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	8 3/4"	0	1100	NONE		
2						
3						

Drill Method: AIR ROTARY
Weight:
Fluid Level (ft) : 337
Hole Medium:
Mud Type:
Time Since Circ:
Viscosity:
Rm: at: Deg C

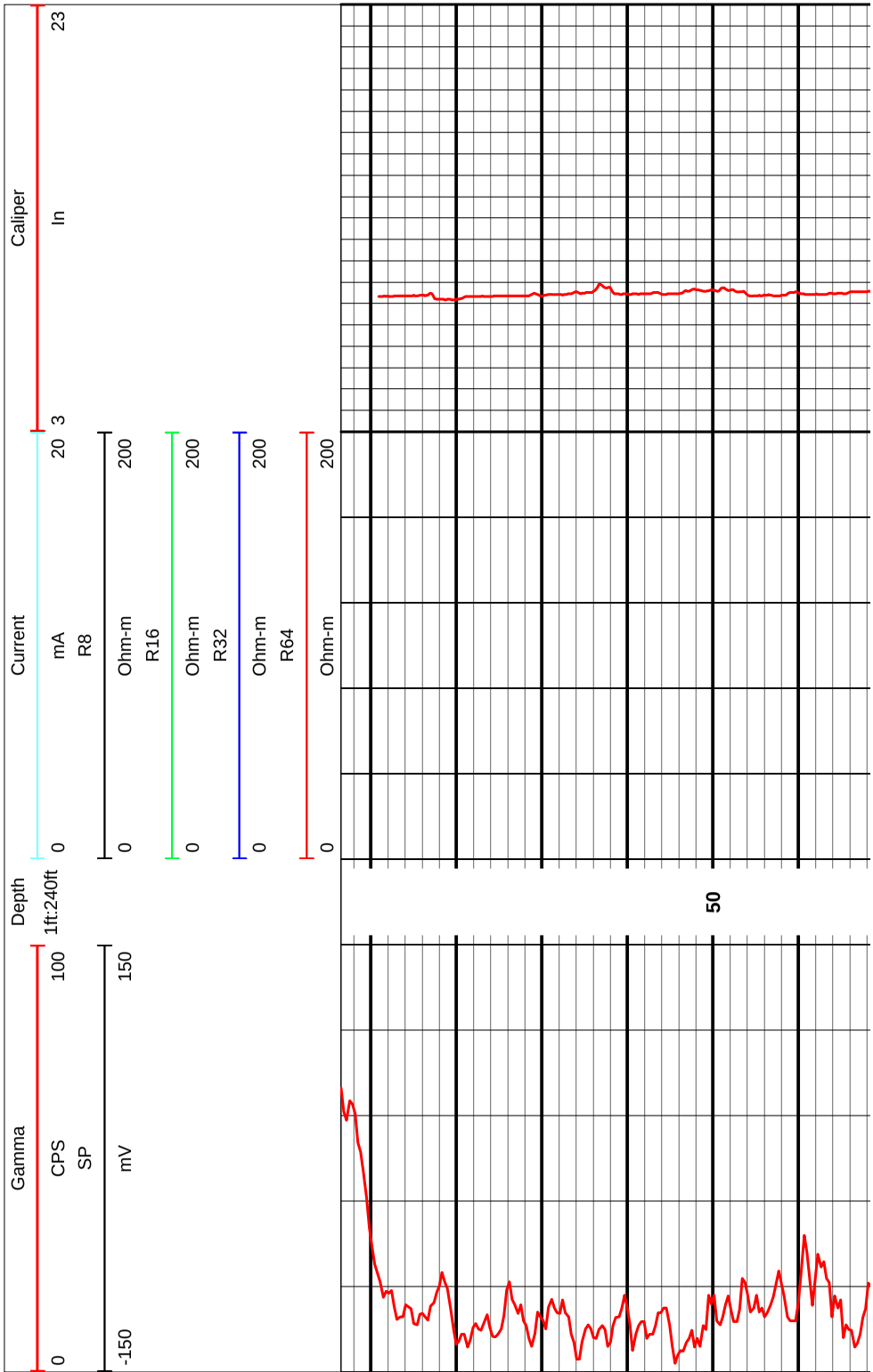
GENERAL DATA

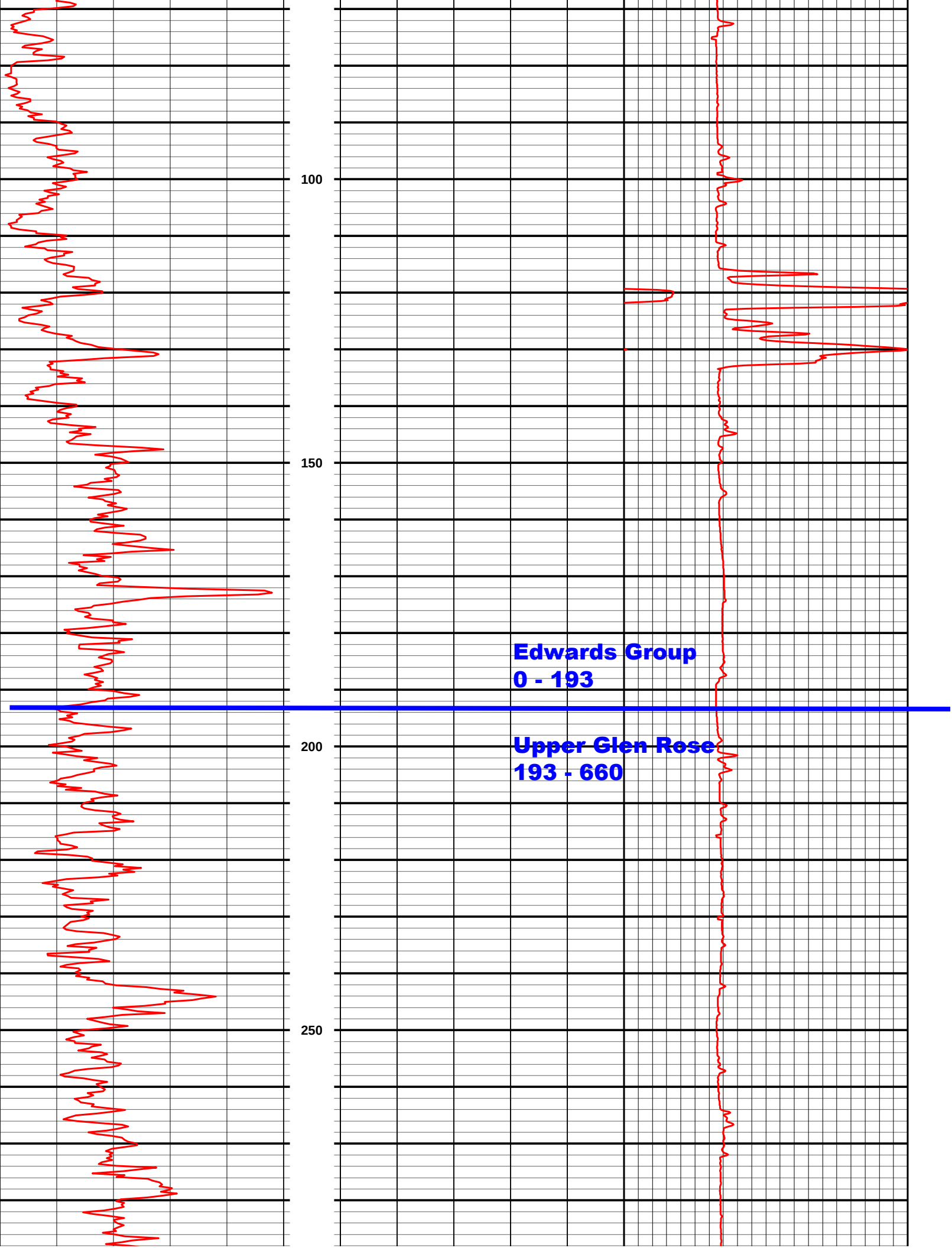
Logged by: Kelly Tuten
Unit/Truck: 05
Witness:

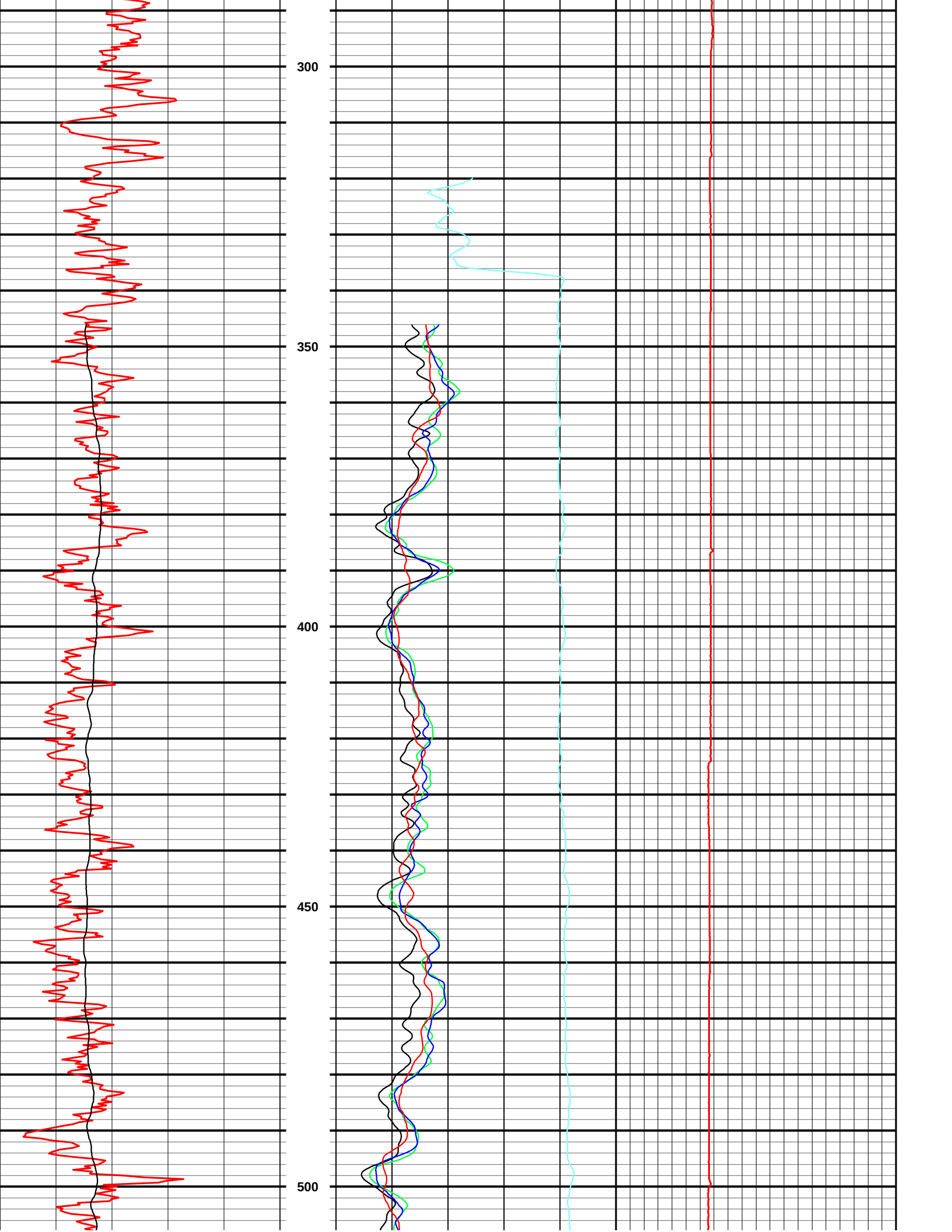
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	2	25	1166	6	20
RESISTIVITY, SP	2	25	1168	346	20
CALIPER	1	55	1169	11	20

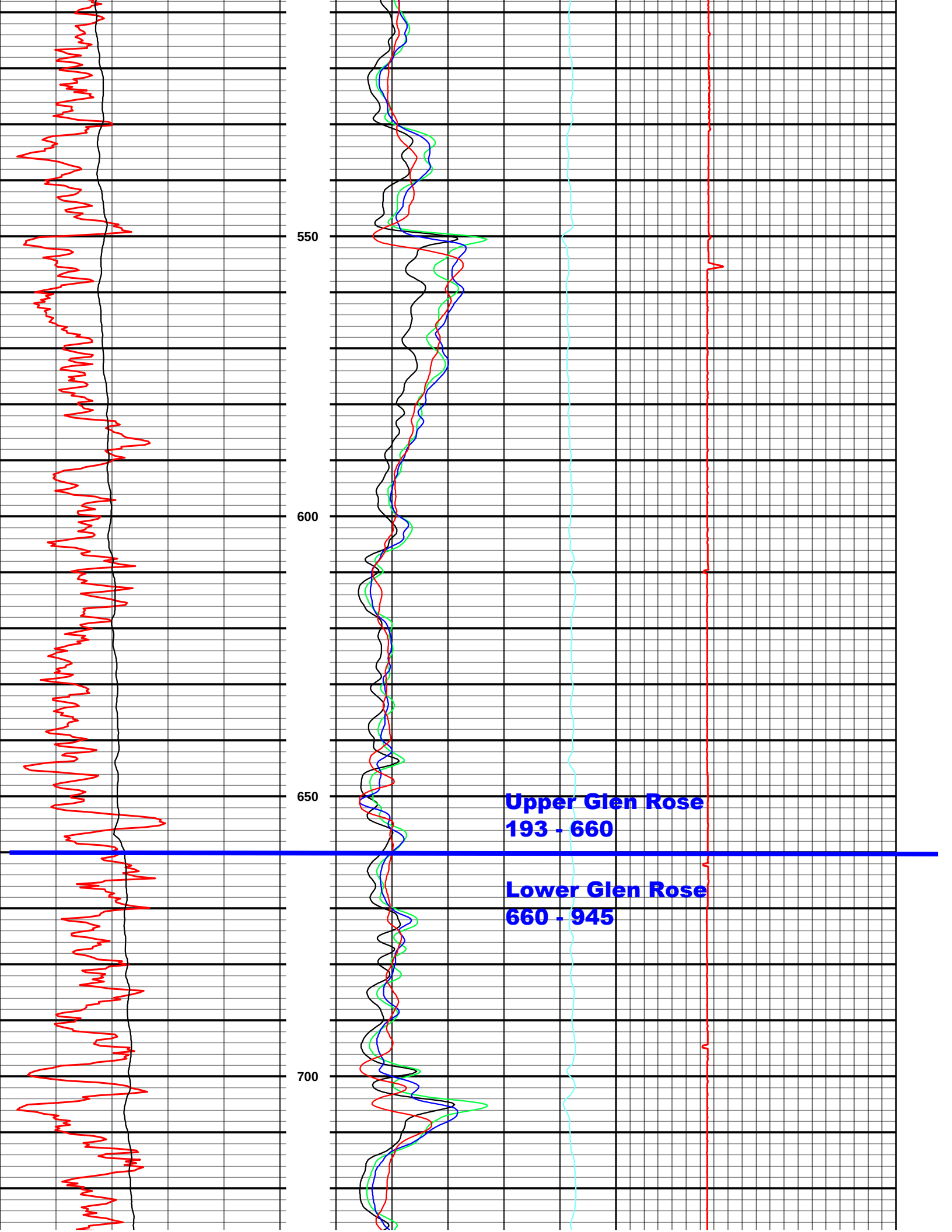
Comments:

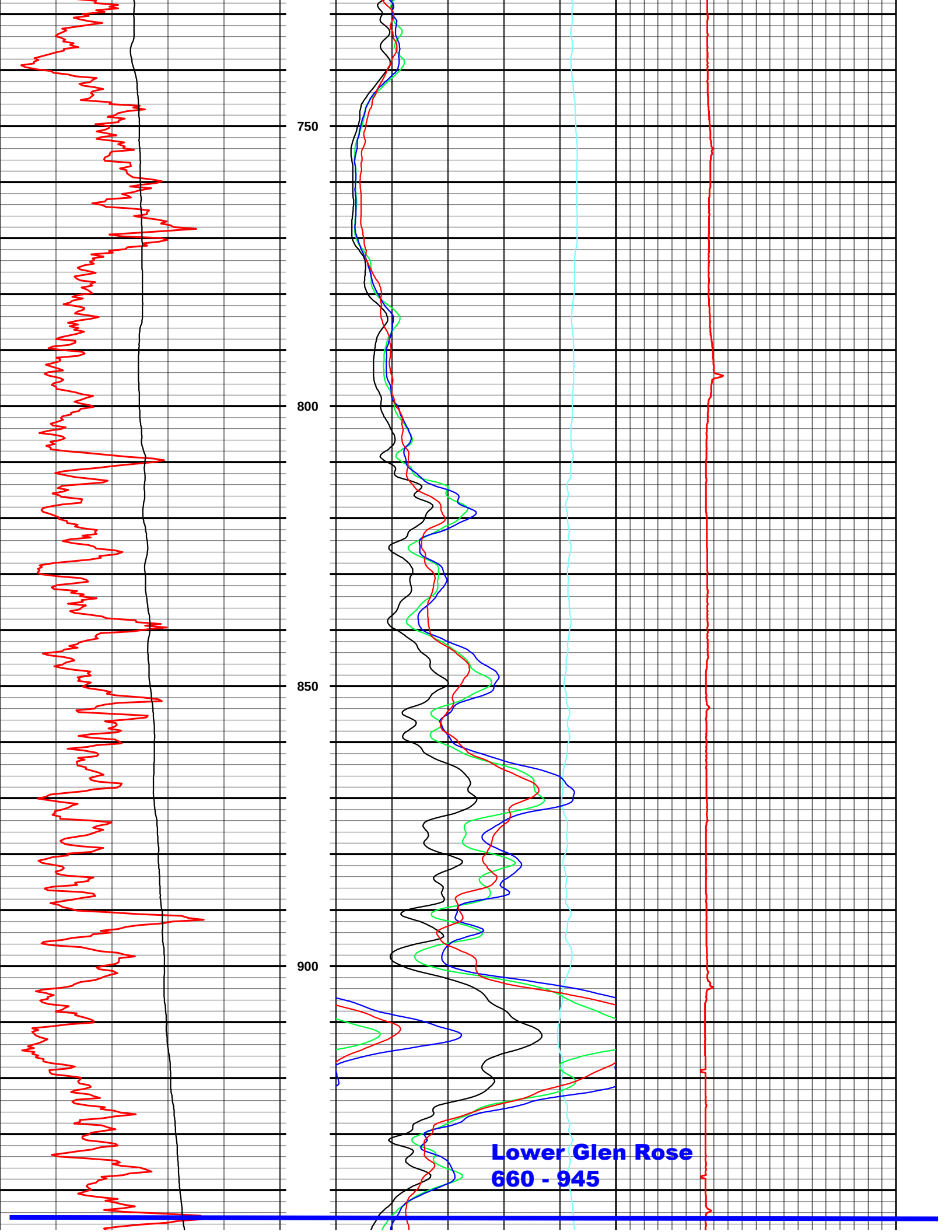
TEST WELL B

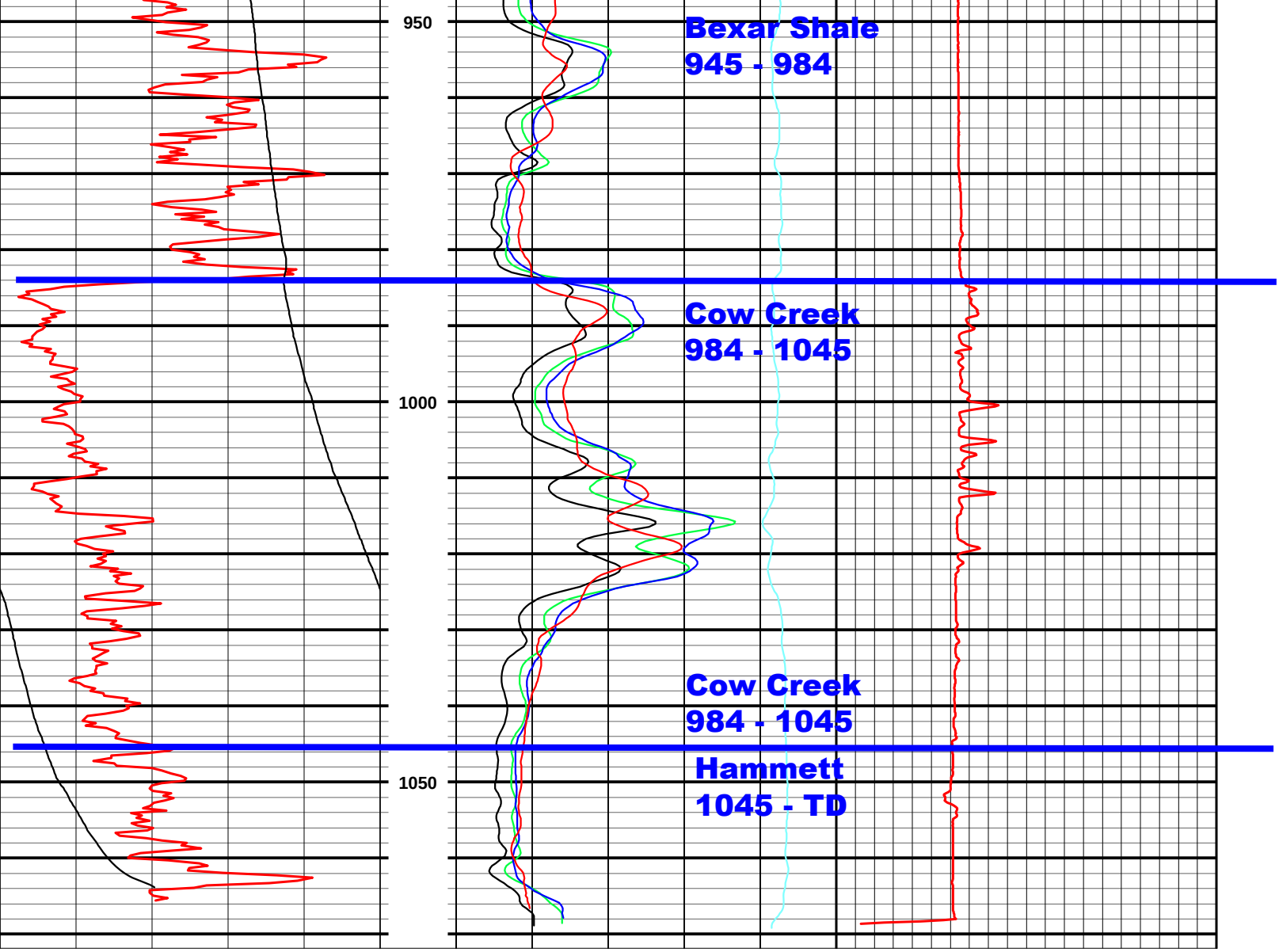



100
150
200
250
Edwards Group
0 - 193
Upper Glen Rose
193 - 660


300
350
400
450
500


550
600
650
700
Upper Glen Rose
193 - 660
Lower Glen Rose
660 - 945


750
800
850
900
Lower Glen Rose
660 - 945


950
1000
1050
Bexar Shale
945 - 984
Cow Creek
984 - 1045
Cow Creek
984 - 1045
Hammett
1045 - TD

GEO CAM

Borehole: NEEDMORE RIVER RANCH

Logs: GAMMA, CALIPER, SPR

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: TEST WELL C

Client: **DAVENPORT DRILLING**

Location: N29* 57' 37.9" W98* 01' 35.9"

Date: 12-07-11

County: HAYS

State: TX

BOREHOLE DATA

Drilling Contractor: DAVENPORT DRILLING

Elevation: 925' GPS

Depth Ref: G.L.

Driller T.D. (ft) : 1060'

Logger T.D. (ft) : 1038'

Date Drilled: 12-07-11

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	8 3/4"	0	TD	NA		
2						
3						

Drill Method: AIR ROTARY

Weight:

Fluid Level (ft) : 170'

Hole Medium:

Mud Type:

Time Since Circ:

Viscosity:

Rm: at: Deg C

GENERAL DATA

Logged by: Robert C. Becknal

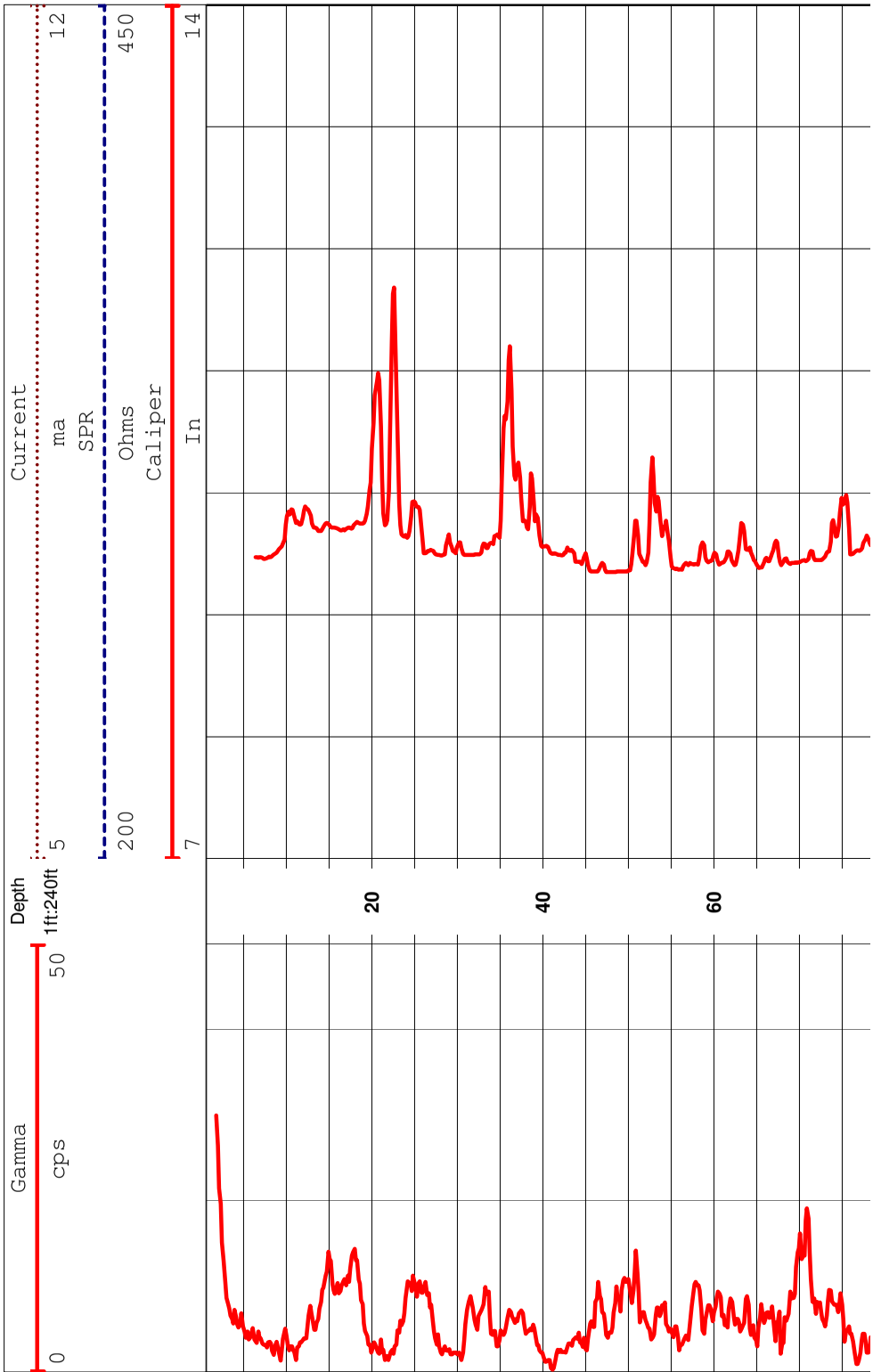
Unit/Truck: 03

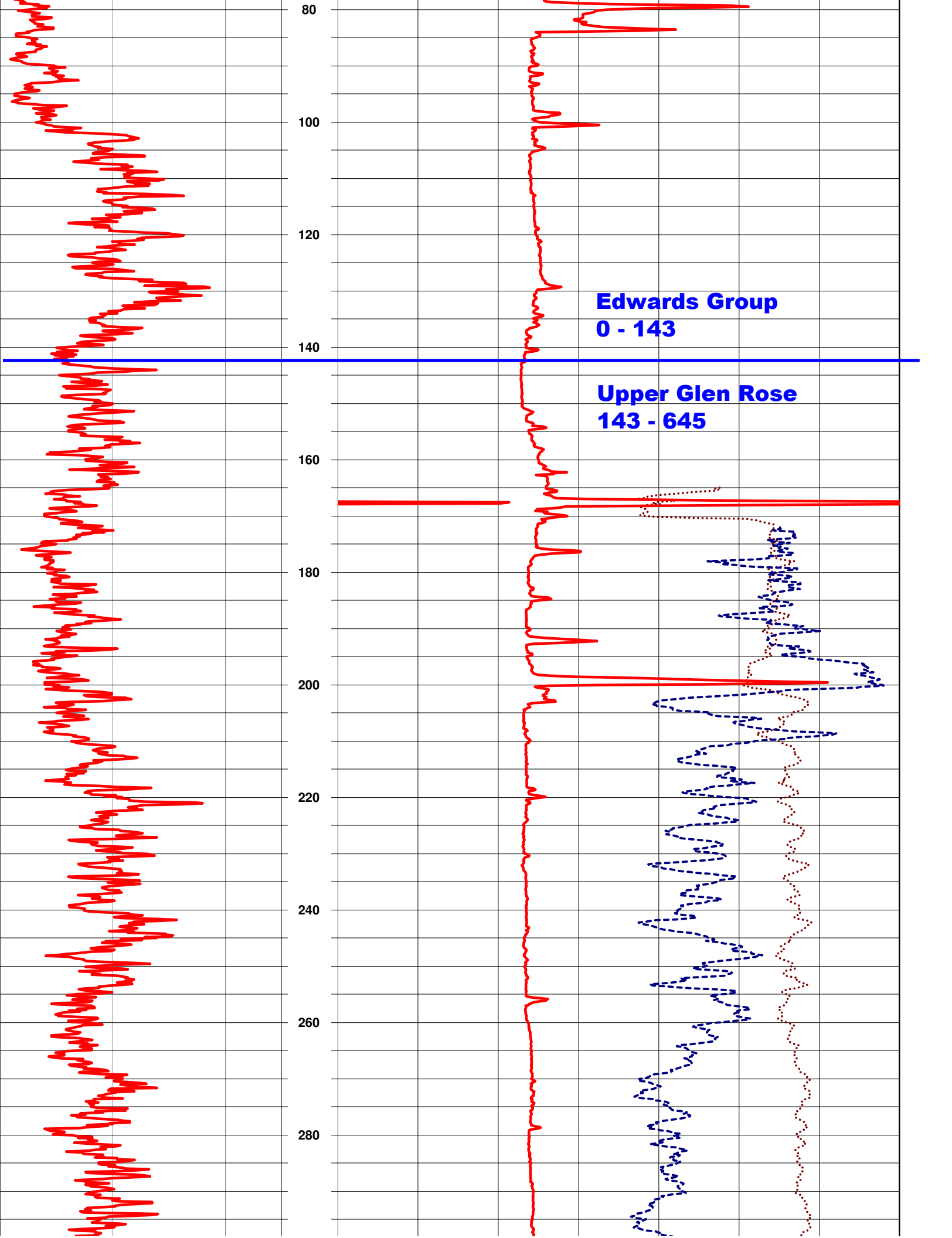
Witness:

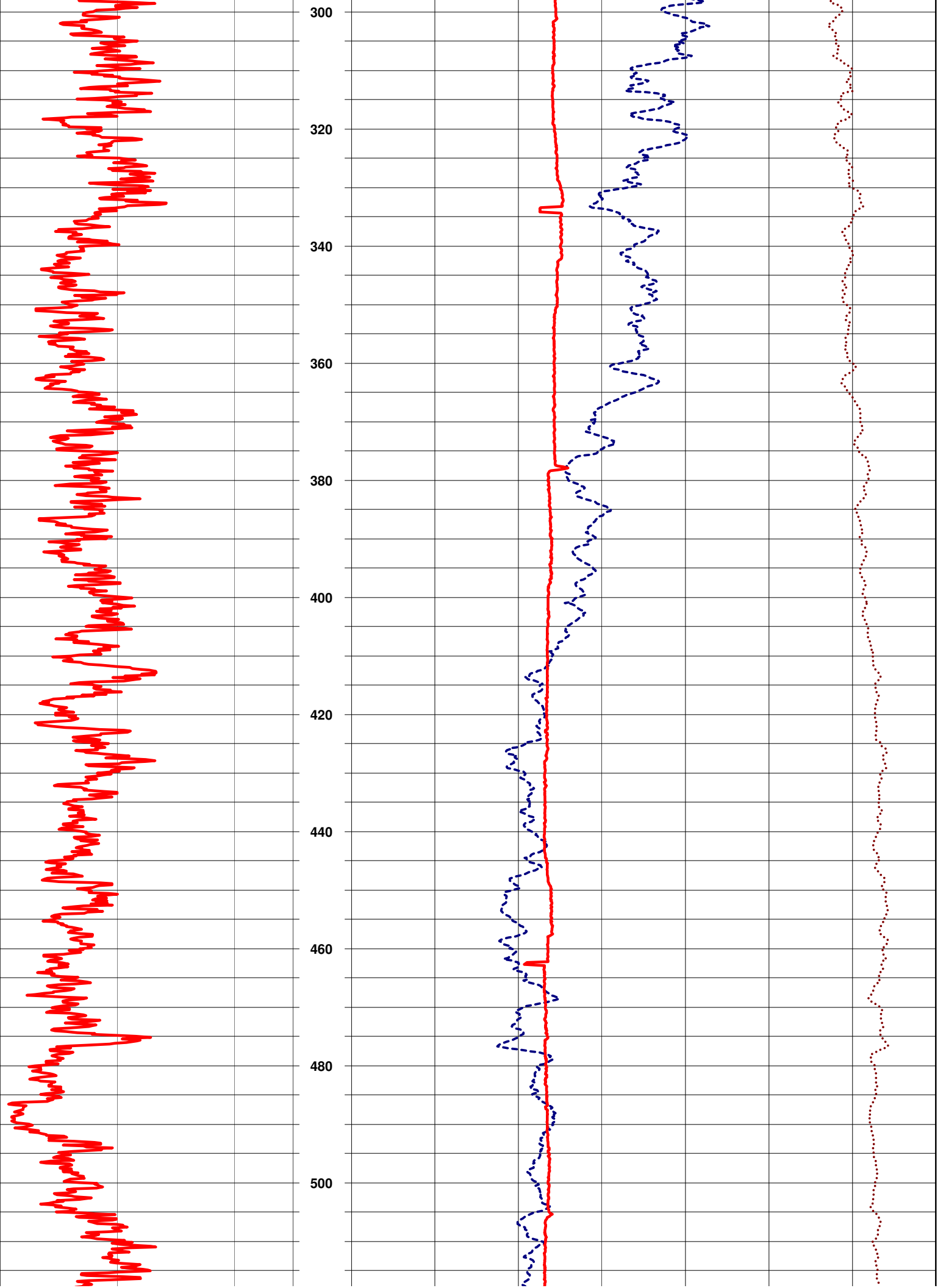
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	2	25	1033'	2'	20
CALIPER	2	25	1037'	6'	20
SPR	1	30	173'	1031'	20

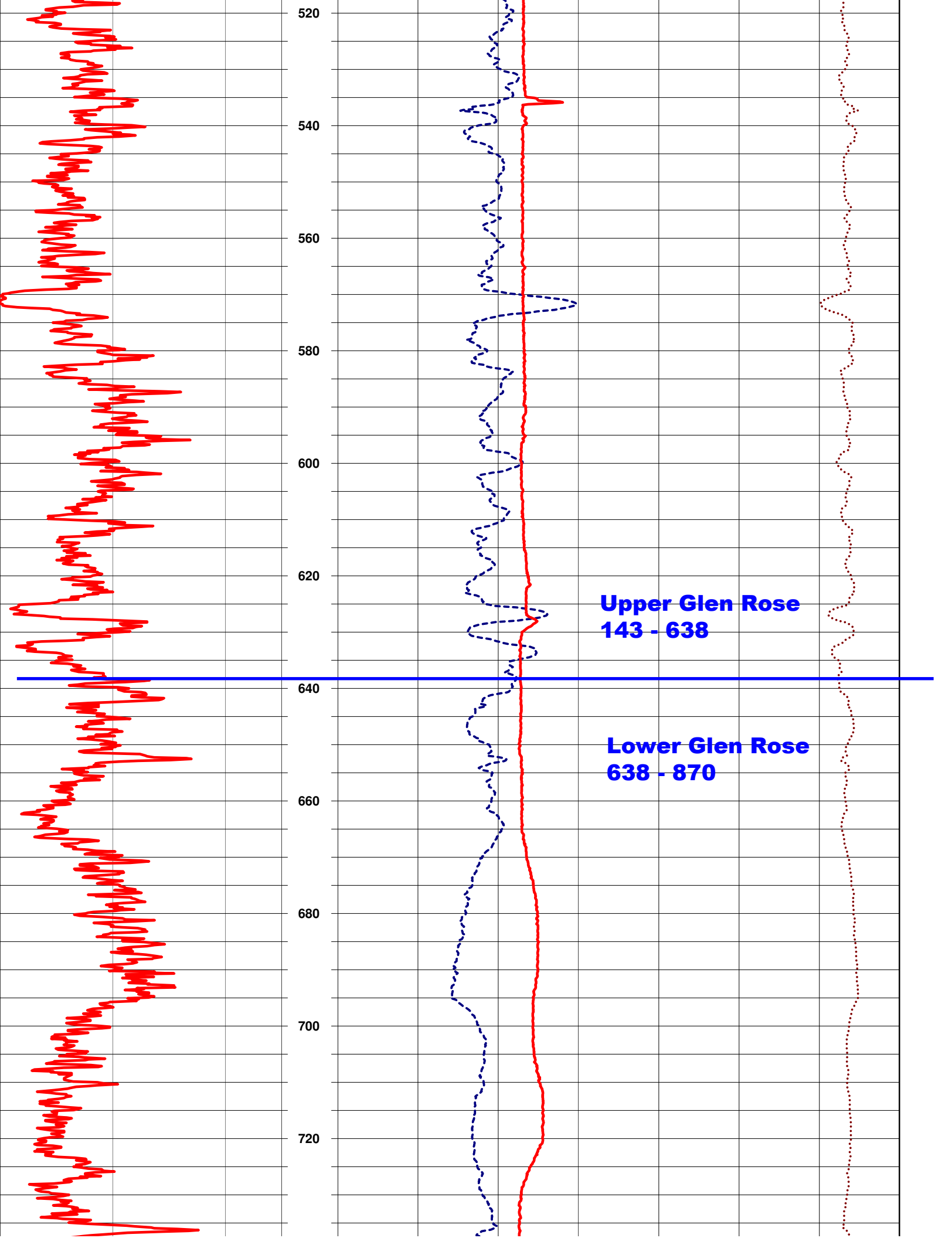
Comments:

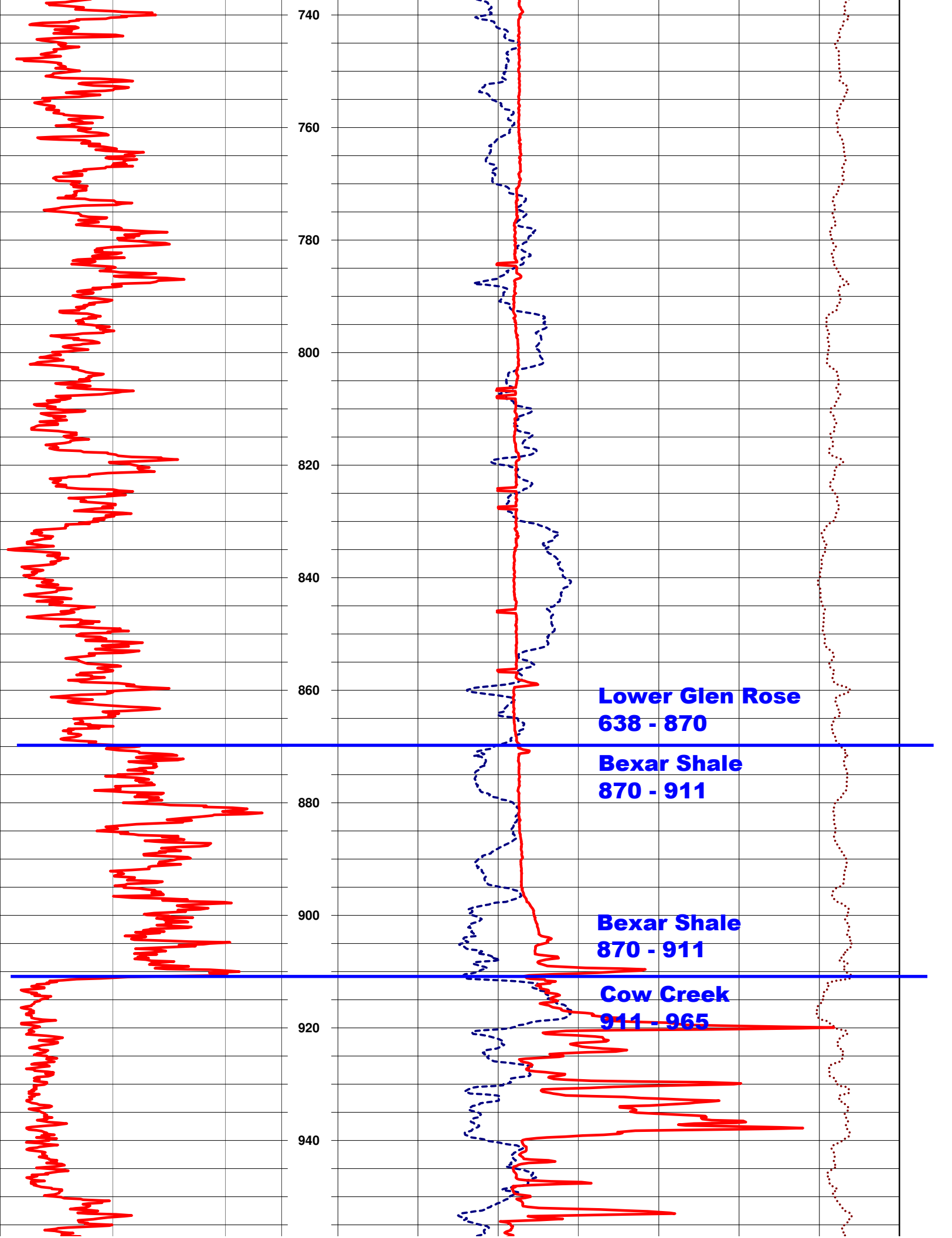
TEST WELL C

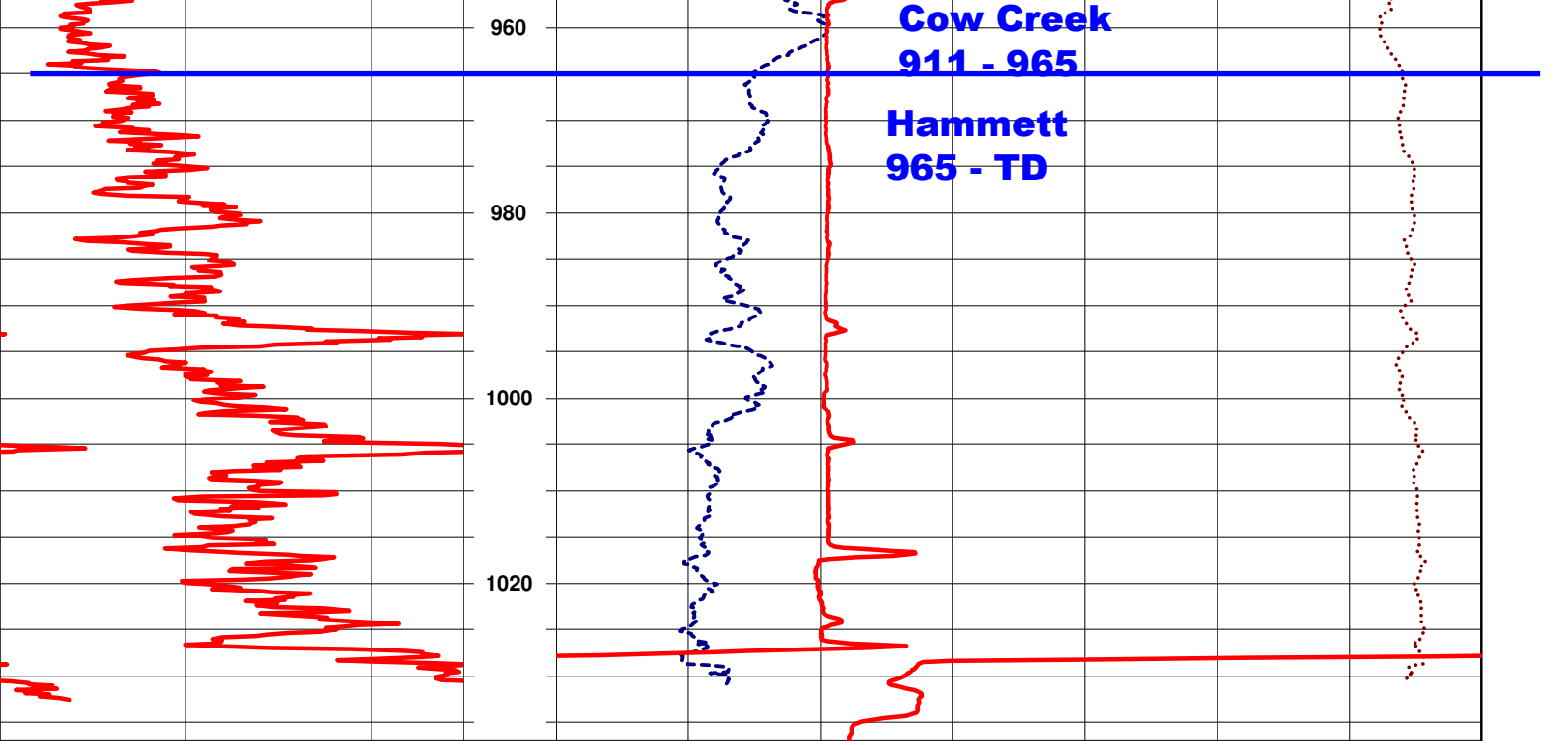



80
100
120
140
160
180
200
220
240
260
280
Edwards Group
0 - 143
Upper Glen Rose
143 - 645


300
320
340
360
380
400
420
440
460
480
500


520
540
560
580
600
620
640
660
680
700
720
Upper Glen Rose
143 - 638
Lower Glen Rose
638 - 870


740
760
780
800
820
840
860
880
900
920
940
Lower Glen Rose
638 - 870
Bexar Shale
870 - 911
Bexar Shale
870 - 911
Cow Creek
911 - 965


960
980
1000
1020
Cow Creek
911 - 965
Hammett
965 - TD

AMOS WELL

Hays- Trinity GCD

Borehole Name or #: **Amos Mointor Well**

Logs: **GR, RES**

Logging Dates: **12/3/2015**

Well Owner: **Amos**

Well Regist. #:

Latitude: Longitude: Hays County, Texas

Elevation MSL: **Topo:** **GPS:** **Google Earth:** GPS Datum: **WGS 84** **NAD 27**

Borehole Data

Drilling Contractor: Date Drilled:

Measuring Point: **2'** **Feet Above Ground Level** Driller TD:

Depth Reference: **Ground Level** Logger TD: **868**

Water Level: **Feet Below Measuring Point**

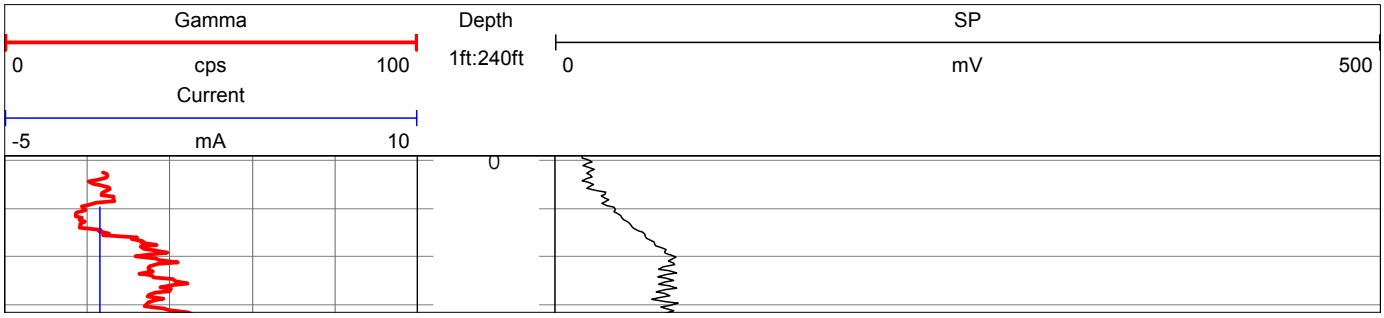
Bit Record				Casing Record			
Run	Bit Size	From	To	PVC / Steel	Size	From	To
1		0					
2							
3							

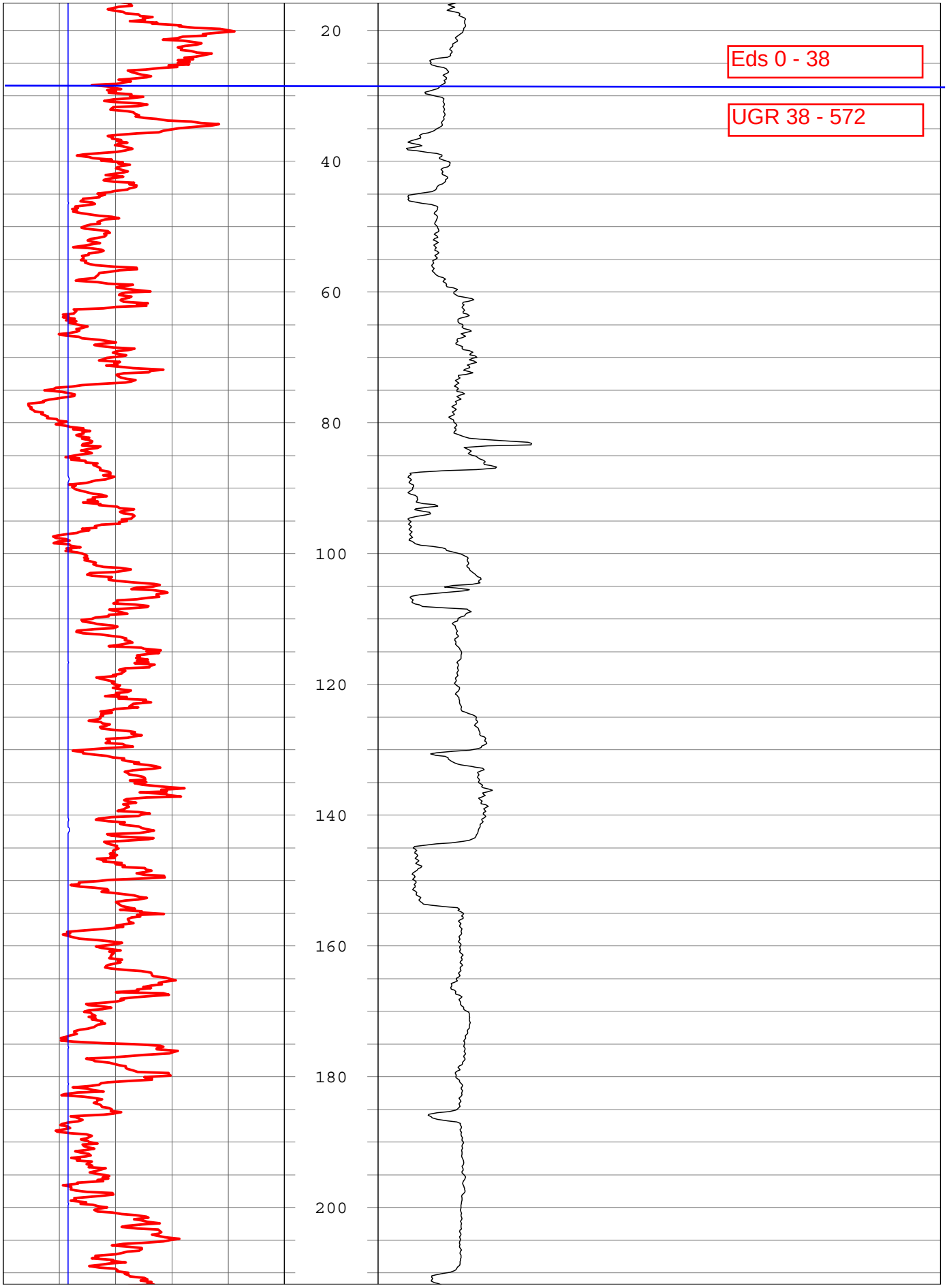
Logging Data

Logged By: Witness:

Log Type	Run #	Up / Down	From	To	Feet / Min.
GR	1	UP	868'	5.15'	15
RES	2	UP	868'		15
	3				
	4				

Comments:

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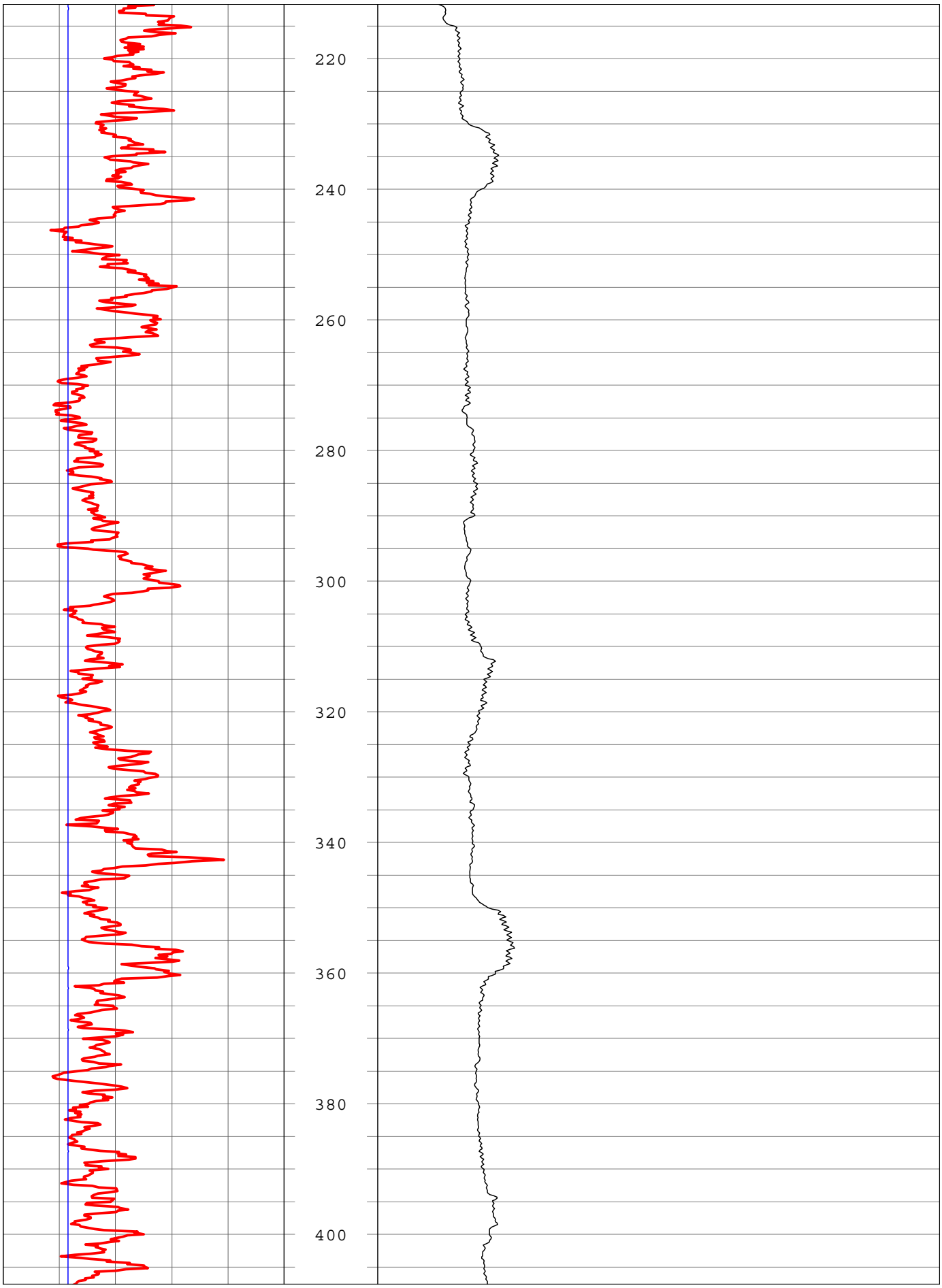
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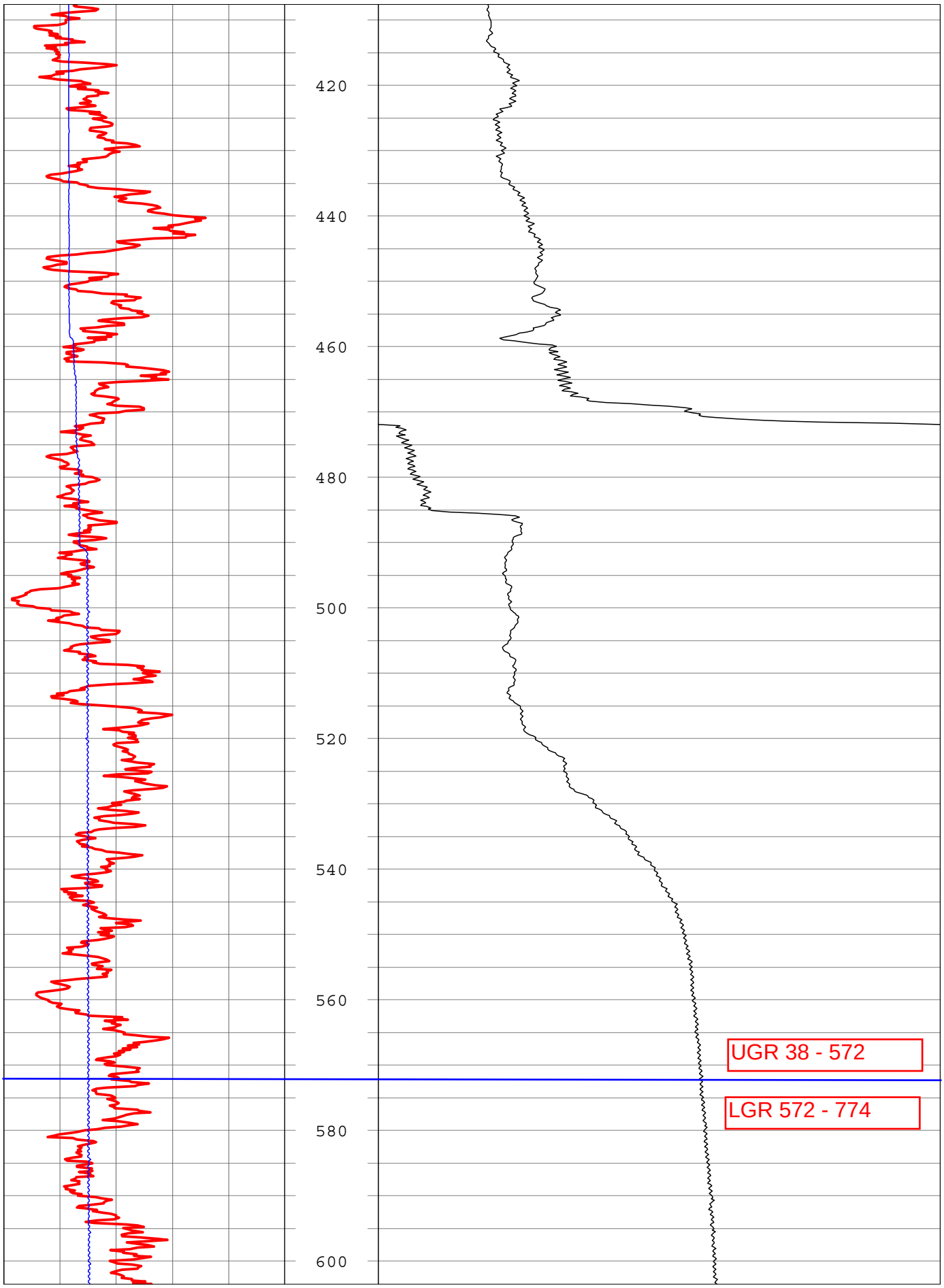
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600
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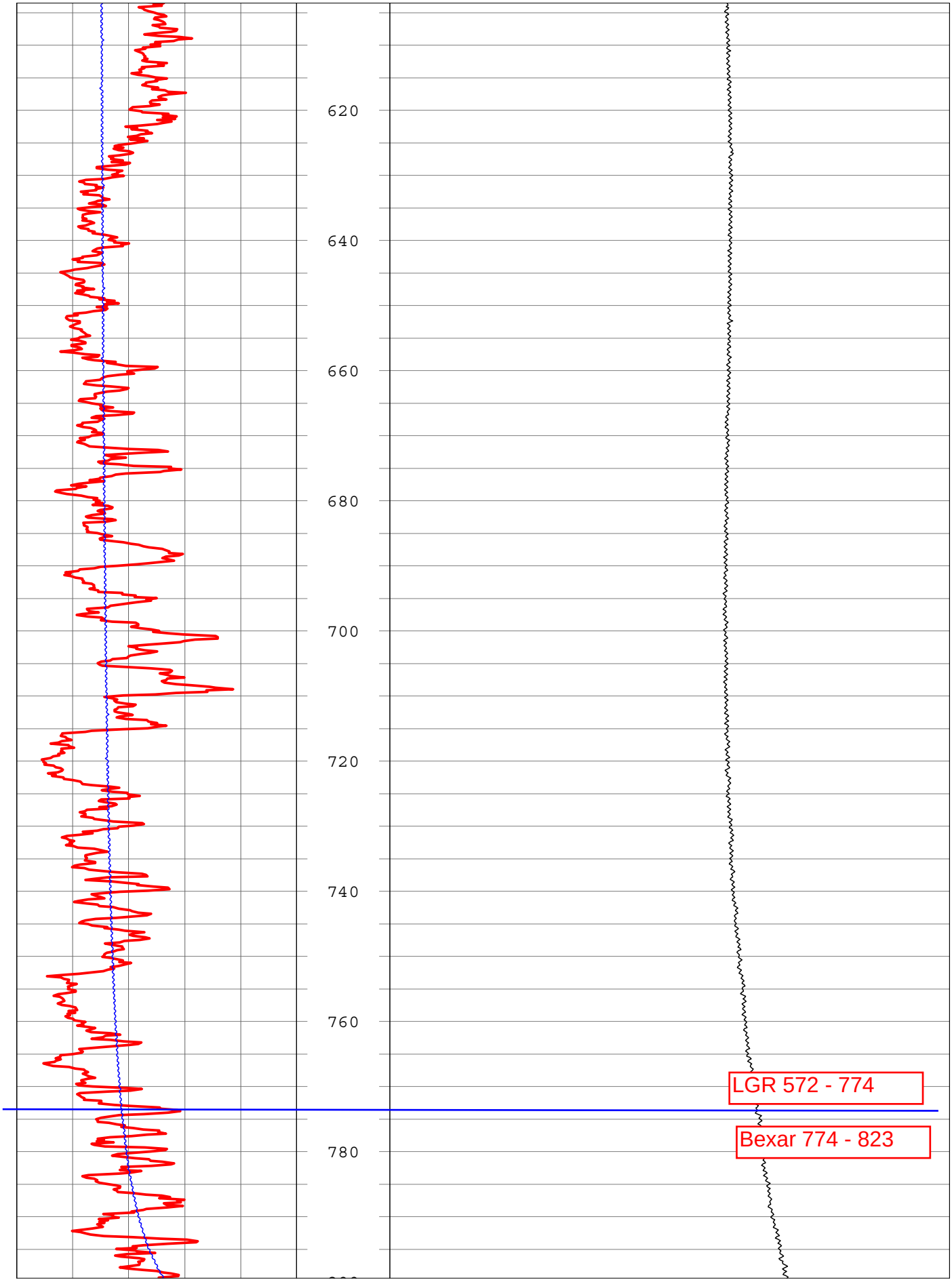
LGR 572 - 774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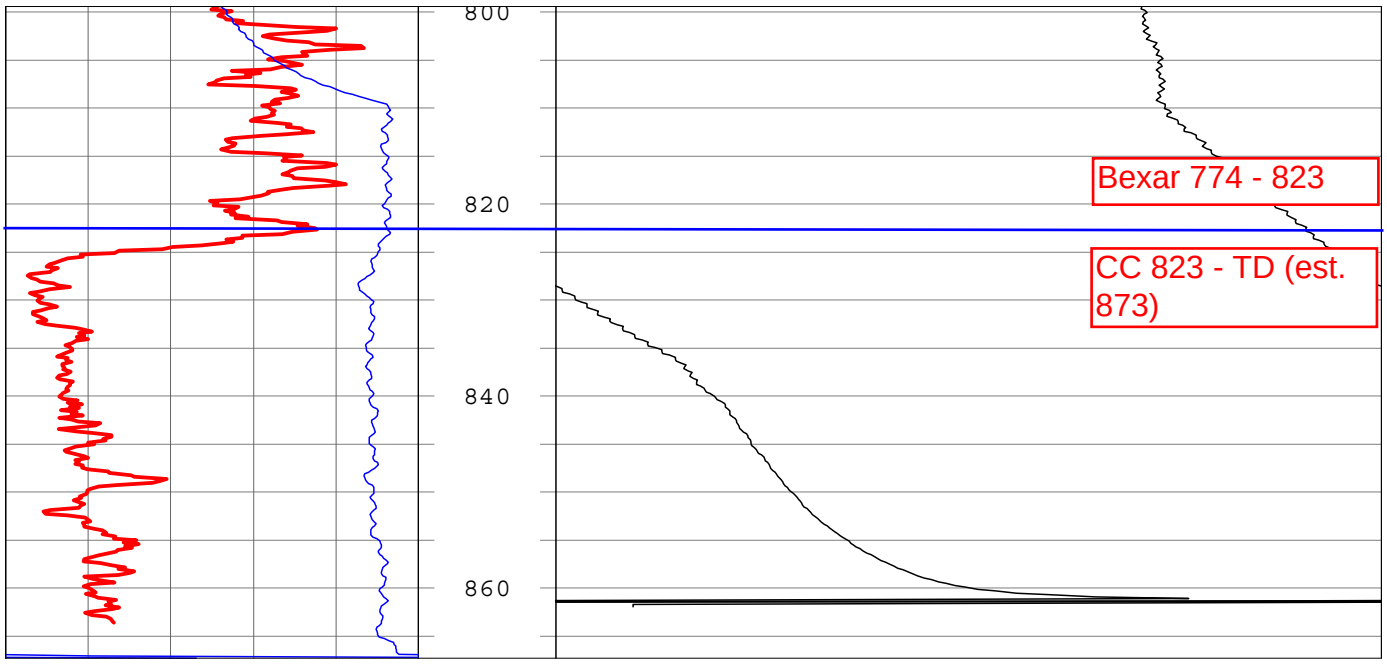
680
700
720
740
760
780
LGR 572 - 774
Bexar 774 - 823


800
820
840
860
Bexar 774 - 823
CC 823 - TD (est. 873)

Appendix E

Well Reports

ORIGINAL WELL D

STATE OF TEXAS WELL REPORT for Tracking #317171

Owner:	**GREG LAMANTIA**	Owner Well #:	**WELL D**
Address:	**3900 N. MCCOLL RD. MCALLEN, TX 78501**	Grid #:	**68-08-3**
Well Location:	**2400 LITTLE ARKANSAS RD. WIMBERLY, TX 78676**	Latitude:	**29° 58' 15" N**
		Longitude:	**098° 02' 04" W**
Well County:	**Hays**	Elevation:	**No Data**

Type of Work: **New Well** Proposed Use: **Irrigation**

Drilling Start Date: **10/16/2012** Drilling End Date: **2/25/2013**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
12.25	**0**	**460**
9.875	**460**	**800**

Drilling Method: **Air Rotary**

Borehole Completion: **Open Hole**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**460**	**242**

Seal Method: **TREMMIE**

Sealed By: **DAVENPORT DRILLING**

Distance to Property Line (ft.): **150+**

Distance to Septic Field or other concentrated contamination (ft.): **150+**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **ESTIMATE**

Surface Completion: **Surface Slab Installed**

Water Level: **290 ft.** below land surface on **2013-02-25** Measurement Method: **Unknown**

Packers: **SHALE 460'**

Type of Pump: **Submersible**

Well Tests: **Pump** **Yield: 400 GPM with 30 ft. drawdown after 24 hours**

Water Quality:

Strata Depth (ft.)	Water Type
740	**TRINITY**

Chemical Analysis Made: **Yes**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **DAVENPORT DRILLING AND PUMP SERVICE**

11844 BANDERA RD. PMB 711
HELOTES, TX 78023

Driller Name: **RICK PFEIFFER** License Number: **50268**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
ELOG ON FILE		

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia. (in.)	New/Used	Type	Setting From/To (ft.)
8" NEW SDR17PVC FROM 0 TO 460'			

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

Draft ★ AMENDED ★ original tracking # 317171

WELL D - AMENDED

Attention Owner: Confidentiality Privilege Notice on reverse side of owner's copy.

Texas Department of Licensing and Regulation

Water Well Driller/Pump Installer Section
P.O. Box 12157 Austin, Texas 78711 Toll free (800)803-9202 X7880
Email address: water.well@tdlr.texas.gov Web address: www.tdlr.texas.gov

This form must be completed and filed with the department and owner **within 60 days** upon completion of the well.

WELL REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name:	Address:	City:	State:	Zip:
GREG LAMANTIA	3900 N. McCOLL RD.	MCALLEN	TX	78504

2) WELL LOCATION

County:	Physical Address:	City:	State:	Zip:
HAYS	2400 LITTLE ARKANSAS RD	WIMBERLY	TX.	78676

Lat. 29° 58' 12.99" N | Long. 098° 02' 2.99" W | GPS Datum | Elevation

3) Type of Work
☐ New Well ☒ Reconditioning ☐ Replacement ☐ Deepening ☐ Other

4) Proposed Use (check) ☐ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Frac ☒ Irrigation ☐ Injection ☐ Extraction ☐ De-watering ☐ Testwell ☐ Rig Supply ☐ Stock or Livestock ☐ Other: ☐ Public Supply --- If Public Supply, were plans approved? ☐ Yes ☐ No

5) Drilling Date
Started 11 / 04 / 2015
Completed 01 / 18 / 2016

Number of identical wells drilled at this location:

6) Diameter of Hole

Dia.(in)	From (ft)	To (ft)
12 3/4	0	603
9 7/8	603	800

7) Drilling Method (check) ☐ Driven ☒ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Hollow stem Auger ☐ Reverse Circulation ☐ Other:

8) Borehole Completion ☒ Open Hole ☐ Straight Wall ☐ Under-reamed ☐ Filter Packed ☐ Other
Filter packed interval from: ft. to: ft. Size: Type

From (ft.)	To (ft.)	Description and color of formation material
0	89	EDWARDS
89	468	UPPER GLEN ROSE
468	684	LOWER GLEN ROSE
684	730	BEXAR SHALE
730	798	COW CREEK
798	800	HAMMETT CLAY

(Use reverse side of Well Owner's copy, If necessary)

9) Casing, Blank Pipe, and Well Screen Data

Dia. (in.)	New Or Used	Steel, Plastic, etc. Perf., Slotted, etc Screen Mfg., if commercial	Setting (ft) From	Setting (ft) To	Gage Casing Screen
8 5/8	NEW	STEEL	0	603	

10) Annular Seal Data: i.e. (from 0 ft. to 100 ft. 15 sacks of cement)
from: 0 ft. to: 603 ft. 657 sacks of CLASS H
from: ft. to: ft. sacks of
Method Used: PRESSURE PUMP Sealed By: BASIC ENERGY
Distance to septic field or other concentrated contamination: ft.
Distance to Septic Tank: 150+ ft. Distance to Property Line: 507 ft.
Method of Measurement: ESTIMATE Approved by Variance #:

11) Surface Completion Completed by Driller? ☒ Yes
☒ Surface Slab Installed ☐ Surface Sleeve Installed ☐ Pitless Adapter Used ☐ Alternative Procedure Used ☐ Other ☐ Steel Cased

12) Water Level
Static level 274 ft. Date: 1 / 20 / 16
Artesian Flow N/A gpm Method of Measurement E LINE

13) Packers:

Type	Depth	Type	Depth

14) Plugged ☐ Well plugged within 48 hours

Casing left in well: From (ft)	To (ft)	Cement/Bentonite placed in well: From (ft)	To (ft)	#Sacks or Material used
N/A				

15) Type Pump
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder ☐ Other
Depth to pump bowls, cylinder, jet etc., 609 ft.

16) Water Test
Type test ☒ Pump ☐ Bailer ☐ Jetted ☐ Estimated ☐ Other
Yield: 550 gpm with 35 ft. drawdown after 120 hrs.

17) Water Quality
Depth of Strata: 740 Was a chemical analysis made? ☒ Yes ☐ No. Did you knowingly penetrate a strata which contains injurious constituents? ☐ Yes ☒ No
If yes, Type of water GOOD
Check One: ☐ Naturally poor-quality groundwater – type ☐ Hydrocarbons (i.e. gas, oil, etc.) ☐ Hazardous material/waste contamination encountered ☐ Other (describe)

☐ *I certify that while drilling, deepening, or otherwise altering the above described well, injurious water or constituents was encountered and the landowner was informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.*

18) Company & Individual's Name: (type or print) DAVENPORT DRILLING / DONNY DAVENPORT Lic. No.: 2671

Address: 11844 BANDERA RD. # 711 City: HELOTES State: TX Zip 78023

By signing this well report, you certify that you drilled or supervised the drilling of this well and that each and all of the statements herein are true and correct.

Signature: 3 / 4 / 16 Name: DONNY DAVENPORT
Licensed Driller/Pump Installer — Date — Unlicensed Assistant (printed)

TDLR FORM 001WWD / 11-13 *TDLR (Original)* *OVER* *Landowner (copy)* *Driller/Pump Installer (copy)*

STATE OF TEXAS WELL REPORT for Tracking #148941

Owner:	**John O. Quinn**	Owner Well #:	**No Data**
Address:	**O Quinn Ranch Wimberley , TX 78676**	Grid #:	**68-08-3**
Well Location:	**O Quinn Ranch Wimberley , TX 78676**	Latitude:	**29° 59' 27" N**
Well County:	**Hays**	Longitude:	**098° 01' 59" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Domestic**

Drilling Date: Started: **12/2/2005**
Completed: **12/12/2005**

Diameter of Hole: Diameter: **8 in From Surface To 1100 ft**

Drilling Method: **Air Rotary**

Borehole Completion: **Open Hole**

Annular Seal Data: 1st Interval: **From 0 ft to 30 ft with 5 Cement (#sacks and material)**
2nd Interval: **From 290 ft to 310 ft with 5 Cement (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Kutscher Drilling**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **Not Installed**
Approved by Variance: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: Static level: **320 ft. below land surface on 12/12/2005**
Artesian flow: **No Data**

Packers: **2 Rubber Packers 680 & 310 feet**

Plugging Info: Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **Good**
Depth of Strata: **No Data**
Chemical Analysis Made: **No**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information: **Kutscher Drilling Ltd**
3810 Hunter Road
San Marcos , TX 78666

Driller License Number: **54746**

Licensed Well **Daniel Kutscher**

Driller Signature:

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **$mew**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking number (Tracking #**148941**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**10**	**Broken Rock**
10	**40**	**Yellow Limestone**
40	**100**	**Yellow Limestone**
100	**140**	**Blue**
140	**200**	**Gray Limestone**
200	**400**	**Gray Clay**
400	**460**	**No Returns**
460	**500**	**Gray Clay**
500	**730**	**Gray Clay**
730	**740**	**No Returns - 10 GPM**
740	**820**	**Gray**
820	**830**	**Brown Sand - 25 GPM**
830	**1000**	**Gray Sand - 25 GPM**
1000	**1100**	**Gray Sand - 25 GPM**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To	
5	**New**	**PVC SDR#21**	**0**	**700**

STATE OF TEXAS WELL REPORT for Tracking #78197

Owner:	**JOHN O' QUINN**	Owner Well #:	**No Data**
Address:	**2400 Little Arkansas Road Wimberley , TX 78676**	Grid #:	**68-08-2**
Well Location:	**Same Same , TX 78676**	Latitude:	**29° 58' 20" N**
Well County:	**Hays**	Longitude:	**098° 02' 36" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**Reconditioning**	Proposed Use:	**Domestic**

Drilling Date: Started: **5/4/2004**
Completed: **5/4/2004**

Diameter of Hole: Diameter: **5 in From Surface To 300 ft**

Drilling Method: **Cable Tool**

Borehole Completion: **Open Hole**

Annular Seal Data: 1st Interval: **From 0 ft to 30 ft with 6 (#sacks and material)**
2nd Interval: **From 200 ft to 220 ft with 4 (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **KUTSCHER DRILLING**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: Static level: **250 ft. below land surface on 5/4/2004**
Artesian flow: **No Data**

Packers: **Rubber 240 220**

Plugging Info: Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump: **No Data**

Well Tests: **Estimated**
Yield: **3 GPM with 58 ft drawdown after 0.75 hour**

Water Quality: Type of Water: **Good**
Depth of Strata: **No Data**
Chemical Analysis Made: **No**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information: **KUTSCHER DRILLING LTD**
3810 Hunter Road
San Marcos , TX 78666

Driller License Number: **1861**

Licensed Well Driller Signature:	**Charles R Kutscher**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**LCS$**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking number (Tracking #**78197**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
298	**308**	**Light Yellow Limestone**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
4	**New**	**PVC 0 300 Sch 40 PERFORATED 260/300 Feet**	

CABOOSE WELL

0164 ~~0088~~

Attention Owner: Confidentiality Privilege Notice on reverse side of owner's copy.

Texas Department of License and Regulation

Water Well Driller/Pump Installer Program
P.O. Box 12157 Austin, Texas 78711 (512)463-7880 FAX (512)463-8616
Toll free (800)803-9202
Email address: water.well@license.state.tx.us

RECEIVED MAY 22 2001

This form must be completed and filed with the department and owner within 60 days upon completion of the well.

WELL REPORT

A. WELL IDENTIFICATION AND LOCATION DATA

1) OWNER

Name	Address	City	State	Zip
John O-Quinn	3518 Travis ST # 200	Houston	Tx	77002

2) WELL LOCATION

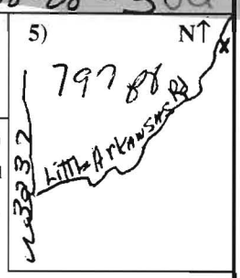
County	Physical Address	City	State	Zip
Hays	2400 Little Arkansas Rd	Wimberley 55.2	Tx	78676

Lat. 29 58 8450.4 Long. 098 01 92 Grid # 68-08-3UQ

3) Type of Work
☒ New Well ☐ Reconditioning ☐ Replacement ☐ Deepening

4) Proposed Use (check) ☐ Monitor ☐ Environmental Soil Boring ☒ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell ☐ Rig Supply
If Public Supply well, were plans submitted? ☐ Yes ☐ No

5) N↑



6) Drilling Date
Started 4 / 20 / 01
Completed 4 / 25 / 01

Diameter of Hole

Dia.(in)	From (ft)	To (ft)
11"	0	118'
6"	118	400'

7) Drilling Method (check) ☐ Driven ☒ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Other

From (ft)	To (ft)	Description and color of formation material
0	18	Topsoil
18	26	Gray clay
26	39	sand and gravel
39	105	light gray limestone
105	107	Shale
107	118	Buda sandstone
118	400	gray limestone

(Use reverse side of Well Owner's copy, If necessary)

8) Borehole Completion ☒ Open Hole ☐ Straight Wall ☐ Under-reamed ☐ Gravel Packed ☐ Other
If Gravel Packed give the interval from ft. to ft.

Casing, Blank Pipe, and Well Screen Data

Dia. (in.)	New Or Used	(Steel), Plastic, etc. Perf., Slotted, etc Screen Mfg., if commercial	Setting (ft) From	Setting (ft) To	Gage Casing	Gage Screen
6	New	Steel	+1	118'	188wall	

9) Cementing Data
Cementing from 0 ft. to 118 ft. # of sacks used 30 bag
ft. to ft. # of sacks used
Method Used pump
Cementing By David Jolander
Distance to septic system field or other concentrated contamination None
Method of verification of above distance

10) Surface Completion
☑ Specified Surface Slab Installed 6" 6'x6'
☐ Specified Surface Sleeve Installed
☐ Pitless Adapter Used
☐ Approved Alternative Procedure Used

11) Water Level
Static level 28 ft. below Date 5 / 7 / 01
Artesian Flow 7 gpm. Date 5 / 7 / 01

12) Packers

Type	Depth

13) Plugged ☐ Well plugged within 48 hours
Casing left in well: Cement/Bentonite placed in well:

From (ft)	To (ft)	From (ft)	To (ft)	Sacks used

14) Type Pump
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other
Depth to pump bowls, cylinder, jet etc., ft.

15) Water Test
Typetest ☐ Pump ☐ Bailer ☐ Jetted ☒ Estimated
Yield: 7 gpm with ft. drawdown after hrs.

16) Water Quality
Did you knowingly penetrate a strata which contain undesirable constituents.
☐ YES ☒ NO If yes, did you submit a REPORT OF UNDESIRABLE WATER
Type of water Good Depth of Strata
Was a chemical analysis made ☐ Yes ☒ No

Company or individual's Name (type or print)	Jolandee Well Drilling	Lic. No. 3053WP
Address 4601 FM 2325	City Wimberley	State Tx Zip 78676

Signature Licensed Driller/Pump Installer	Date	Signature Apprentice	Date
David E Jolander	4 / 25 / 01		/ /

TDLR FORM b001WWD *White - TDLR* *Yellow - Owner* *Pink - Driller/Pump Installer*

29.980667, -98.022917

RIO BRAVO WELL

New ✓

Texas Water Development Board

Well Schedule

State Well Number 68 08 303 Prev. Well No. _____ County Hays County Code 209

Basin 18 GMA 9 RWPA L GCD Hays-Trinity Aquifer Upper Glen Rose

Latitude 29 54 02.44 Longitude 098 01 18.27 Coord Accuracy 0 Aquifer ID1 28 Aquifer ID2 __ Aquifer ID3 __

Owner/ Little Arkansas Driller Unknown

Well No. _____

Address _____ Tenant/Oper. _____

Well Depth 239 Source of Depth S Altitude 787 Source of Alt. Datum D

Date Drilled ___ ___ ___ Well Type W User Code _____

Lift Data Pump Mfr. _____ Type of Lift Subm S Pump Depth Setting (ft) _____ ft.

Motor Mfg _____ Type of Power elec E Horsepower _____

Water Use Primary _____ Secondary _____ Tertiary _____

Other Data Available Water Level M Water Quality Y Well Logs _____ Other Data A

Well Construction Const Method _____ Casing Material PVC P

Completion Method _____ Screen Material _____

Water Levels

Date 11 10 1999 Meas. 31.30 Remarks 09/9 M.P. + -

Date 11 15 1999 Meas. 42.9 Remarks _____

Date ___ ___ ___ Meas. _____ Remarks _____

Water Quality (Remarks: obs. well for this test did not change, did not use

Field Performance Test

Flow Rate _____ Pump Rate _____ GPM Circle how rate was determined: Meas Rept Est Date of Test _____

Length of test 24.5 hr Production Rate 12 GPM Circle how rate was determined: (Meas) Rept Est Date of Test 11/10-12/99

Static Level 31.3 ft. Pumping Level _____ ft. Amount of Drawdown 145 ft. Specific Capacity 0.08 GPM/ft.

Casing Records:

Casing or Blank Pipe (C)
Well Screen or Slotted Zone (S)
Open Hole (O)
Cemented from ___ to ___

	Diam. (in.)	Interval of C,S, or O: From	To
1	C 04		
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

Date Record Collected or Information Updated 9 7 2010 Reporting Agency 01 Recorded by D Baker

Other Remarks

1 Reported yield 12 GPM with 145 feet drawdown
2 after 24.5 hours in 1999. Specific capacity
3 0.08 GPM/ft. Aquifer test data and results in
4 TWDB files.
5 Well 5 BSEAGCD Report 2010-0701.
6

Aquifer

68-08-303

Well Number

Appendix F

Flow Meter Calibration Certificate

ZENNER
All that counts.

State of California
Department of Weights & Measures
Registration No. 3603

Certified Test

Customer:	Gicon Pumps & Equipment	Manufacturer:	ZENNER
Address:	6150 Tri County Pkwy	Model #:	PMT06US
City:	Schertz	Serial #:	346589
State:	TX Zip: 78154	Size #:	6''

High Flow:	1,400	GPM	99.5	%	Tested By: Fred Alonzo
Med. Flow:	200	GPM	100.1	%	Tester #: 08564
Low Flow:	30	GPM	100.9	%	

Comments: _____

Signature: _____ Date: 2/27/15

Zenner | P.O. Box 895, Banning, CA 92220 | 951-849-8822 | www.zennerusa.com

Appendix G

Correspondence with BSEACD Regarding Maximum Production Capacity

Barton Springs Edwards Aquifer
CONSERVATION DISTRICT

September 30, 2015

Sent via certified mail and email

Wet Rock Groundwater Services, LLC
317 Ranch Rd 620 South, Suite 203
Austin, TX 78734

RE: Staff Review of a Temporary Permit Application submitted by Needmore Water LLC , for authorization to produce groundwater from the Middle Trinity Aquifer.

Dear Mr. Kaveh Khorzad:

This letter is to inform you that District staff is currently reviewing the Temporary Permit application submitted by Needmore Water LLC on 9/18/15. In our initial review of the submitted application the District has determined that additional clarification and information are needed. The District requests this additional information in order to gain a better understanding of the application request and expedite the review within limited processing timeframes. Further, the requested information will facilitate determining whether the existing well in operation prior to 6/19/15 is being operated consistent with the authorization sought in the permit.

Please provide the requested information to address the following application requirements:

3-1.55.2 (A)(1) - A detailed statement of the nature and purpose of the existing uses.

On the application form, you indicated "agricultural irrigation" and "general irrigation" as the current uses types for of the well. The descriptive statement submitted with the application does not provide enough information or description of the agricultural and/or general irrigation operations. This information is integral to the characterization of the primary use type and verification of beneficial use.

The District requests that the applicant provide a written statement and associated supporting documentation that expands upon the statement of use provided in the application. The written statement should address the following:

- Provide a description of the existing agricultural and/or general irrigation uses supplied by the well in operation prior to 6/19/15.

- Provide a detailed description of the vegetation currently receiving irrigation from this well and other relevant related information (e.g. cultivated crops, native vegetation, recreation areas, landscaping, etc.).
- Provide clarification on whether the request is primarily used for agricultural irrigation or general irrigation or a combination of irrigation use types. If both, provide an estimate of the proportions of general versus agricultural irrigation demand.
- Provide a detailed description of the existing irrigation system(s) used to convey and distribute produced groundwater from the well(s) to the irrigated area including maps, diagrams, schematics, or other relevant supporting documentation describing the irrigation equipment and infrastructure.

3-1.55.2 (A)(8) - A description of the location of the proposed receiving area for the water to be produced.

- Please confirm that the location shown on the receiving area map is the only existing receiving area for the produced water from well (D).
- If applicable, please provide a description and a map that depicts all locations of the existing receiving area for the produced water from well (D).
- Please provide the approximate irrigated area (acres, sq ft) for each area.

3-1.55.2 (A)(2) – The requested annual permit volume not to exceed maximum production capacity and supporting documentation.

With the limited information provided in the application, the requested volume, which is assumed to represent maximum production capacity, does not appear to be practically feasible. Several factors contribute to this conclusion including: the relatively short well testing data (<24 hrs), completion of the well limiting pump size, and a pumping level that did not reach a steady-state for the pumping rate of 430 gpm prior to cessation of the test. Accordingly, we would like to request the following information:

- Please confirm that 887 acre/ft/year requested is based on the "maximum production capacity" of the well as defined by statute. Or provide an alternate basis if the requested volume is not being requested as the "maximum production capacity".
- Please confirm that the well is constructed as the final completion for permanent production.
- Please provide the pump model and specifications for:
    1. the pump which was used to conduct the well test on November 14, 2012;
    2. the pump that is currently installed in the well; and
    3. the increased capacity pump that could be installed in the well as it is currently completed, which was used to derive the pumping rate for the requested permit volume.

- Please provide the intended run time of the well (pumping duration) on an annual basis and the intended pumping rate (gpm) for that intended pumping duration.

3-1.55.2 (A)(9) – Other facts and considerations. Given the time-sensitive nature of the review and this information request, the District also requests access to the property for a site visit of the well and associated irrigation/conveyance system in order to expedite this permit review within limited processing timeframes. We believe this will be the most efficient and effective way to better understand the requested authorization.

Please note that the deadline to complete the application review and issue a Temporary Permit is **10/19/15.** In order to timely process this application within these limited timeframes, we request that you provide the above requested information by **10/7/15.** The District very much appreciates your cooperation in assisting staff in this application review in order to provide a smooth and expeditious transition into a permit.

Please contact us as soon as possible to schedule the site visit. Please also feel free to contact us if you have any further questions or need clarification regarding the requested information. You may contact my office by phone at 512/282-8441 or by e-mail at jdupnik@bseacd.org

Sincerely,

John T. Dupnik, P.G.
General Manager

cc:

Needmore Water LLC
3900 N. McColl Rd
McAllen, TX 78501

Ed McCarthy
Jackson, Sjoberg, McCarthy & Townsend LLP
711 West 7th Street
Austin, Texas 78701

Bill Dugat
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Wet Rock Groundwater Services, L.L.C.
Groundwater Specialists
TBPG Firm No: 50038
317 Ranch Road 620 South, Suite 203
Austin, Texas 78734 • Ph: 512-773-3226
www.wetrockgs.com

October 9, 2015

Mr. John Dupnik
Barton Springs/Edwards Aquifer Conservation District
1124 Regal Row
Austin, TX 78748

RE: Needmore Water LLC Temporary Permit Application

Dear Mr. Dupnik:

This letter is in reply to your letter dated September 30, 2015 requesting additional information regarding the Needmore Water, LLC temporary permit application. Each of your separate "requests" is restated below followed by our responses.

3-1.55.2 (A)(1) – A detailed statement of the nature and purpose of the existing uses.

Response: The LaMantia Ranch, locally known as Needmore Ranch, covers approximately 5,071 acres in western Hays County. The LaMantia Family purchased the Ranch from the Estate of John O'Quinn in the spring of 2011. Since purchasing the Ranch, the LaMantia Family has worked to improve the agricultural productivity and management across the Ranch, planning long-term to use the Ranch for such activities as a cattle yearling operation and open space for the Family. Greg LaMantia serves as the Family's manager of ranching operations. Since acquiring the Needmore Ranch, the LaMantia's have been working to restore the overgrazed pasture lands across the property. This multi-year process, which is ongoing, included the following steps:

1. Remove all livestock from the property – the herd of cattle acquired with the ranch has been sold off. Some pastures have been fenced off to isolate and/or exclude wildlife, e.g., deer herds, etc.

2. The overgrazed pasture lands have been allowed to lay fallow and recover from the overgrazing they experienced due to the prior owner's poor agricultural and animal husbandry management practices. The pastures also either have been or will be planted with improved grasses, including some non-native and annual species, *e.g.*, hay grazer, coastal oats, that will require irrigation to supplement the available rainfall. Along with pasture rotations, the owners will also multi-crop annually rotating crops based upon seasons.

3. Once the pastures have been allowed to recover and become reestablished for grazing purposes, the ranch will be restocked with both cattle and deer.

4. During the past year, Needmore Ranch has been researching and soliciting bids and cost estimated for various types of pipeline and related irrigation equipment, including center

pivot systems. The irrigation of the property was for the purposes of watering native grasses on the property in the area surrounding the Blanco River in addition to other parts scattered throughout the Ranch.

A brief description of specific steps taken by the Family to bring the Ranch back to peak operating efficiency since 2011 is summarized below:

Agricultural Improvements (See attached map):

1. **Two-Mile Cross Fence Construction:** This fence runs from north to south and crosses the center of the Ranch. The new cross fence allows the Ranch to be divided into the three primary pastures: north, southeast and southwest. The primary purpose of the five stranded barbed wire cross fence is for herd management and pasture rotation. This cross fence is not an eight-foot game fence and is not intended for wildlife/game management. Approximate investment: $160,000.00.

2. **Reseeding with Native Seed Mix:** Hundreds of acres have been reseeded within the north pasture with native seed mix. Reseeding has been completed by seed spreaders mounted on four-wheelers or by hand spreaders in less accessible areas. The reseeding began in 2011 and has been progressing since. Areas that have been fallowed and reseeded in 2011 and 2012 are showing evidence of improved ground cover and native grass recovery. Approximate investment to date: $250,000.00.

3. **Resting the Southwest Pasture:** While improving the agricultural infrastructure on the Ranch during the past four years, the number of head of cattle onsite has been reduced. The ongoing drought over the past years reinforced the necessity to reduce the number of cattle from the Ranch, and to allow the pastures an opportunity to recover from the historic over grazing that occurred prior to 2011. Pre-2011, the ranching operation was running approximately 350 cows and only utilizing approximately 1/3 of the Ranch (the Southwest Pasture). Previous cattle operations were concentrated around the Ranch headquarters due the lack of water distribution across the Ranch.

4. **Disking and Seeding the Sections in the North Pasture:** In the spring of 2013, the two lower pastures along the Blanco River floodplain were disked and native grass seed planted. These pastures currently contain llamas.

Depending upon the level of growth in the reseeded pastures and climatic conditions, plans are to stock 250-400 yearling steers on the Ranch annually. The number of head will be highly influenced by the current drought conditions on the Ranch. This will be the first significant placement of cattle onto the Ranch since the purchase and agricultural improvements have been put on the ground.

5. **Providing Water Source in the Three Major Pastures:** One of the most important elements to allow for a switch back, or three-pasture rotation is to provide water within all three of the pastures. Prior to 2011, the only major water source for the cattle operations was the domestic well located at the Ranch headquarters. This lead to the concentration of cattle and degradation of this area. Water improvements include:

a. **North Pasture:** The LaMantia's constructed Pond 1 in the north pasture to capture and provide reliable surface water throughout the north pasture. Approximate investment: $150,000.00

b. **Southeast Pasture:** The LaMantia's constructed 2.5 miles of water pipeline to provide reliable water within the pasture. Approximate investment: $25,000.00

c. **Southwest Pasture:** This pasture includes the ranch headquarters and did not require additional

water improvements. Approximate total water source investment to date: $175,000.00

d. **Groundwater Development:** In 2102, the Needmore Ranch commissioned Wet Rock Groundwater Services, LLC to conduct an extensive hydrogeological study of the property in an effort to better understand the water resources underlying Ranch. As part of that study extensive test well drilling was conducted; this resulted in the completion of the existing Well D. The objective of the well was to supply water to wildlife and stock on the property in addition to use as irrigation well in the future. As discussed below, and in greater detail in the report that accompanied the pending HB 3405 Applications, there is an abundant quantity of groundwater within the Middle Trinity Aquifer of good to reasonable quality for application to farming and ranching activities. Of the test wells drilled as part of the 2012 study, only Well D was completed to be operational. The other wells were plugged following completion of the study.

   In addition to its planned irrigation use of groundwater, the Ranch received permission from the United States Army Corps of Engineers to construct a ponded water feature which is used for watering both domestic livestock, and the native wildlife. The location of Well D, is outside of the Hill Country Priority Groundwater Management Area. The pond is constructed in a location designed to capture rainfall sheet flow on the property, however, the well is used periodically to supplement this water feature at times.

3-1.55.2 (A)(8) – A description of the location of the proposed receiving area for the water to be produced.

Response: The area receiving the water produced from Well D is to be used on the map submitted with the permit application, the water feature approved by the US Army Corps of Engineers and areas that have not been finalized yet planned for irrigation throughout the Ranch.

3-1.55.2 (A)(2) – The requested annual permit volume not to exceed maximum production capacity and supporting documentation.

- **Please confirm that 887 acre-ft/year requested is based on the "maximum production capacity" of the well as defined by statute. Or provide an alternate basis if the requested volume is not being requested as the "maximum production capacity."**

Response: The 887 acre-ft/yr is based upon the calculated "maximum production capacity" of the well as defined by House Bill (HB) 3405. Within HB 3405 "maximum production capacity" is defined as:

> *the maximum production capacity of a well, which may be based on a 36-hour pump test conducted at the time the well was initially constructed or placed into service.*

The 887 acre-ft/yr was calculated as the maximum production capacity that the well could produce based upon the results of the aquifer test conducted on November 14, 2012 and based upon the largest pump that could fit within the well. The aquifer test conducted on November 14, 2012 consisted of a constant rate test of ~430 gpm for approximately 22.4 hours resulting in a final drawdown measurement of 37.99 feet. Although when graphed the data indicated a drawdown occurring, the rate and magnitude of that drawdown was small enough to provide for calculation of aquifer properties. Between 8 hours into the test for the remaining 14 ½ hours until the pump was shut off, the well experienced less than 5 feet of drawdown.

The aquifer parameters calculated from the test resulted in a specific capacity of 11.27 gpm/ft and a transmissivity of 523 ft^2/day. Based upon the test results, it is apparent that the well can produce in

excess of 430 gpm however it is limited by the size of the largest pump that can fit within the well. To determine the "maximum production capacity" of the well we located the largest pump that could fit within this well and determine the production rate at a given Total Dynamic Head (TDH) determined from the aquifer test. TDH was determined as shown below:

TDH	
Static W.L. (November 14, 2012)	**287.07 ft.**
Pumping W.L. @ 428 gpm	**325.06 ft.**
Pumping W.L. @ 550 gpm (est)	**336.0 ft.**
Frictional Loss in Column @ 550 gpm (6" Steel)	**9.2 ft.**
TDH @ 550 gpm	**345.2 ft.**

- **Please confirm that the well is constructed as the final completion for permanent production.**

Response: It is our understanding that the well is completed to final completion for the intended beneficial purposes described in the applications.

- **Please provide the pump model and specifications for:**

1. **The pump which was used to conduct the well test on November 14, 2012.**

   Response: We do not typically record the pump model used during the aquifer tests; however the pump used was a 6-inch submersible pump with a 60 HP motor and set on 4-inch steel column pipe set at 588 feet.

2. **The pump that is currently installed in the well; and**

   Response: The pump currently installed in the well is a Grundfos 475S500-6A

3. **The increased capacity pump that could be installed in the well as it is currently completed, which was used to derive the pumping rate for the requested permit volume.**

   Response: The increased capacity pump that could be installed is a Grundfos 475S600-7

- **Please provide the intended run time of the well (pumping duration) on an annual basis and the intended pumping rate (gpm) for that intended pumping duration.**

  Response: To achieve the 887 acre-ft/yr the "maximum production capacity" was determined based upon the largest pump that could fit within the well. At 550 gpm running 24 hours a day and 7 days a week the well would produce 887 acre-ft/yr.

3-1.55.2 (A)(9) - Other Facts and Considerations.

Response: Pursuant to your request, we have schedule a site visit to the Needmore Ranch for 2:30pm, Wednesday, October 14, 2015. By separate communication, we will provide you with directions to the rendezvous point at the Ranch.

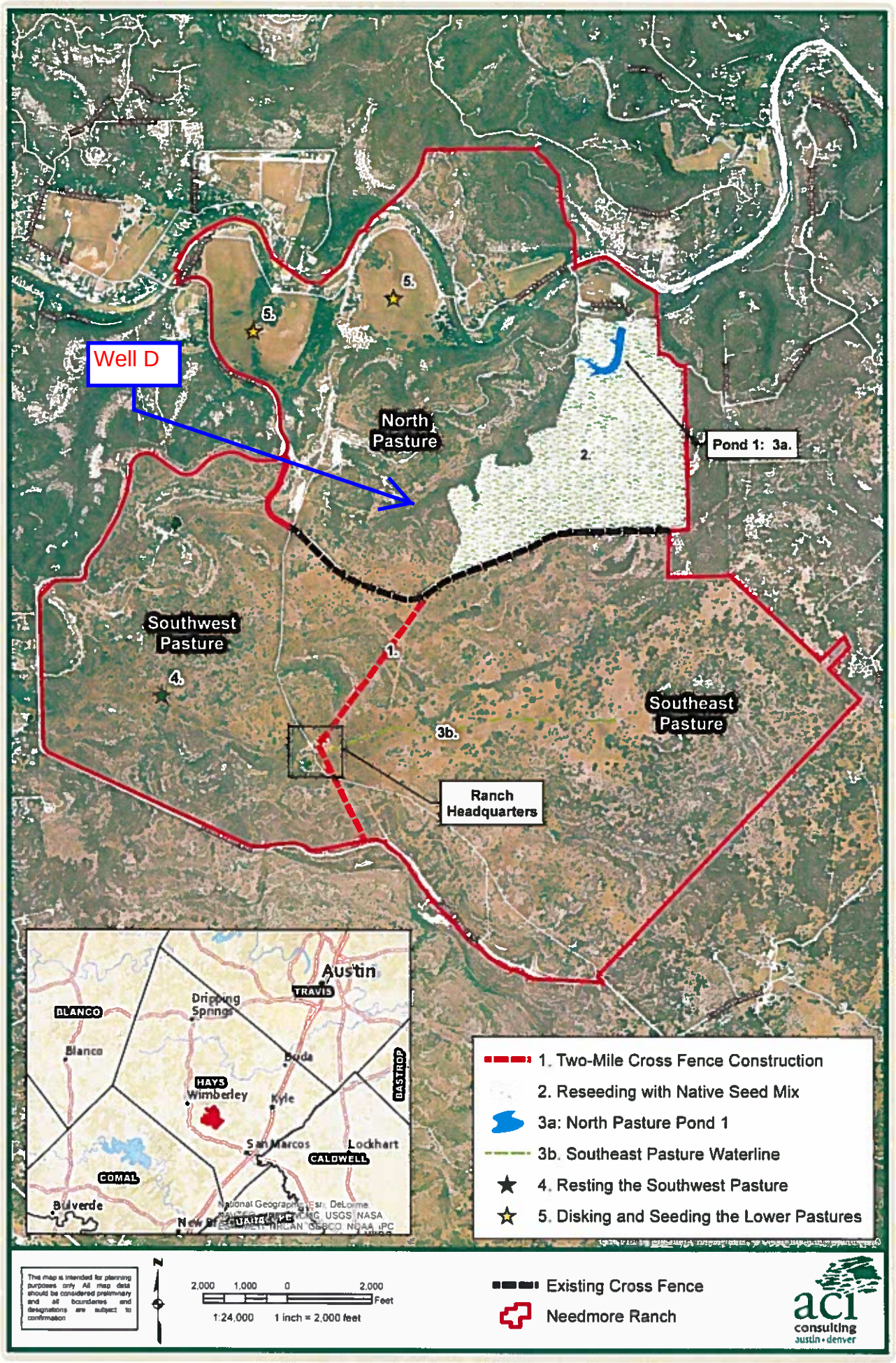
Please call me at 512-773-3226 if you have any questions or require additional information.

Respectfully,

Wet Rock Groundwater Services, L.L.C.

Kaveh Khorzad, P.G.
President/ Senior Hydrogeologist

Cc:
Mr. Greg LaMantia
Mr. Ed McCarthy



La Mantia (Hays County)
Figure 1: Agricultural Improvements

May 2014

Appendix H

Aquifer Test Data and Analyses

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/20/2016 10:27			76.62	274.54	661.46										Static Prior Testing Pump Rate
1/20/2016 10:28			76.67	274.53	661.47										
1/20/2016 10:29	0		76.71	274.70	661.30	0.00									Pump Start
1/20/2016 10:30	1		76.75	285.99	650.01	11.29	555	49.17					671.72	0.00	Meter start = 11,150 gallons
1/20/2016 10:31	2		76.75	285.79	650.21	11.09	555	50.03							
1/20/2016 10:32	3		76.71	285.87	650.13	11.17	550	49.23							
1/20/2016 10:33	4		76.66	286.08	649.92	11.38	550	48.33							
1/20/2016 10:34	5		76.60	285.97	650.03	11.27	550	48.79							
1/20/2016 10:35	6		76.53	286.22	649.78	11.53									
1/20/2016 10:36	7		76.47	286.18	649.82	11.48									
1/20/2016 10:37	8		76.39	286.15	649.85	11.46									
1/20/2016 10:38	9		76.31	286.54	649.46	11.85									
1/20/2016 10:39	10		76.24	286.18	649.82	11.49	550	47.89							
1/20/2016 10:40	11		76.18	285.94	650.06	11.24							671.58	0.14	
1/20/2016 10:41	12		76.13	286.21	649.79	11.51									
1/20/2016 10:42	13		76.09	286.45	649.55	11.75									
1/20/2016 10:43	14		76.06	286.37	649.63	11.67									
1/20/2016 10:44	15		76.03	286.26	649.74	11.56	550	47.57							
1/20/2016 10:49	20		75.93	286.38	649.63	11.68	550	47.11							
1/20/2016 10:54	25		75.82	286.54	649.46	11.84	550	46.46							
1/20/2016 10:59	30		75.73	286.72	649.28	12.02	550	45.76							
1/20/2016 11:14	45		75.67	286.93	649.07	12.24	550	44.95							
1/20/2016 11:29	60		75.69	287.18	648.82	12.48	550	44.08							
1/20/2016 11:33	64	0	75.68	287.04	648.96	12.34	550	44.57					671.69	0.03	Stop Pump Rate Test
1/20/2016 11:34	65	1	75.67	275.66	660.34	0.96									Meter: 50,120 gallons
1/20/2016 11:35	66	2	75.66	276.17	659.83	1.47									
1/20/2016 11:36	67	3	75.62	275.98	660.02	1.28									

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/20/2016 11:37	68	4	75.57	275.98	660.02	1.28									
1/20/2016 11:38	69	5	75.52	275.74	660.26	1.04									
1/20/2016 11:39	70	6	75.52	275.92	660.08	1.22									
1/20/2016 11:40	71	7	75.55	275.60	660.40	0.90							671.76	-0.05	
1/20/2016 11:41	72	8	75.61	275.82	660.18	1.12									
1/20/2016 11:42	73	9	75.71	275.76	660.25	1.06									
1/20/2016 11:43	74	10	75.82	275.71	660.29	1.01									
1/20/2016 11:44	75	11	75.95	275.47	660.53	0.77									
1/20/2016 11:45	76	12	76.11	275.45	660.55	0.75									
1/20/2016 11:46	77	13	76.27	275.51	660.49	0.81									
1/20/2016 11:47	78	14	76.42	275.69	660.31	0.99									
1/20/2016 11:48	79	15	76.57	275.60	660.40	0.90									
1/20/2016 11:53	84	20	77.33	275.14	660.86	0.44									
1/20/2016 11:58	89	25	77.79	275.50	660.50	0.80									
1/20/2016 12:03	94	30	78.18	275.43	660.57	0.73									
1/20/2016 12:18	109	45	77.93	274.88	661.12	0.18									
1/20/2016 12:33	124	60	77.75	275.24	660.76	0.55									
1/20/2016 12:48	139	75	77.49	274.79	661.21	0.09									
1/20/2016 13:03	154	90	77.47	274.92	661.08	0.22									
1/20/2016 13:18	169	105	77.41	274.60	661.40	-0.10									
1/20/2016 13:33	184	120	77.37	274.61	661.39	-0.09									
1/20/2016 13:49	200	136	77.27	274.51	661.49	-0.19									Water Level Recovered to Original Static
1/20/2016 13:50			77.28	274.52	661.49								671.22	-0.49	Start Background Water Level Readings
1/20/2016 14:50			77.03	274.74	661.26								670.63		
1/20/2016 15:50			76.86	274.62	661.38								670.28		
1/20/2016 16:50			76.75	274.62	661.38								670.05		

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/20/2016 17:50			76.66	274.16	661.84								670.67		
1/20/2016 18:50			76.61	274.11	661.89								671.01		
1/20/2016 19:50			76.56	274.52	661.48								671.14		
1/20/2016 20:50			76.53	274.50	661.51								671.13		
1/20/2016 21:50			76.51	274.51	661.49								671.36		
1/20/2016 22:50			76.46	274.12	661.89								671.20		
1/20/2016 23:50			76.43	273.97	662.03								671.33		
1/21/2016 0:50			76.43	274.34	661.66								671.48		
1/21/2016 1:50			76.40	274.28	661.72								671.52		
1/21/2016 2:50			76.41	274.00	662.00								671.66		
1/21/2016 3:50			76.38	274.18	661.82								671.71		
1/21/2016 4:50			76.37	274.09	661.92								671.68		
1/21/2016 5:50			76.37	273.67	662.33								671.78		
1/21/2016 6:50			76.35	273.63	662.37								671.77		
1/21/2016 7:50			76.36	274.09	661.91								671.79		
1/21/2016 8:50			76.35	274.08	661.92								671.80		
1/21/2016 9:50			76.35	273.66	662.34								671.77		
1/21/2016 10:50			76.35	274.08	661.92						664.62		671.73		Manual reading from Catfish Pond Well
1/21/2016 11:50			76.34	274.04	661.96								671.83		
1/21/2016 12:50			76.35	274.03	661.97				675.30				671.91		Start of Top of the Hill Well water levels
1/21/2016 13:50			76.34	273.59	662.41				675.22				671.94		
1/21/2016 14:50			76.35	273.95	662.06				675.25				672.00		
1/21/2016 15:50			76.35	273.93	662.07				675.26				671.14		
1/21/2016 16:50			76.36	273.54	662.46				675.25				671.22		
1/21/2016 17:50			76.36	273.43	662.57				675.24				671.30		
1/21/2016 18:50			76.36	273.98	662.02				675.26				670.89		
1/21/2016 19:50			76.37	273.56	662.44				675.24				671.33		

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/21/2016 20:50			76.37	273.58	662.42				675.24				671.38		
1/21/2016 21:50			76.36	274.08	661.92				675.20				671.19		
1/21/2016 22:50			76.37	273.66	662.34				675.17				671.59		
1/21/2016 23:50			76.37	274.04	661.96				675.17				671.76		
1/22/2016 0:50			76.36	274.03	661.97				675.19				671.77		
1/22/2016 1:50			76.36	273.97	662.03				675.19				671.75		
1/22/2016 2:50			76.37	273.58	662.42				675.22				671.87		
1/22/2016 3:50			76.38	273.96	662.05				675.22				671.88		
1/22/2016 4:50			76.37	273.47	662.53				675.24				671.85		
1/22/2016 5:50			76.38	273.87	662.13				675.30				672.09		
1/22/2016 6:50			76.37	273.38	662.62				675.30				672.08		
1/22/2016 7:50			76.38	273.38	662.62				675.30				672.05		
1/22/2016 8:50			76.37	273.92	662.08				675.29				672.03		
1/22/2016 9:50			76.37	273.42	662.58				675.30				671.98		
1/22/2016 10:50			76.34	273.47	662.53				675.27				671.87		
1/22/2016 11:50			76.36	273.84	662.16				675.25				671.89		
1/22/2016 12:50			76.37	273.93	662.07				675.25				671.96		
1/22/2016 13:50			76.36	273.44	662.56				675.25				671.95		
1/22/2016 14:50			76.35	273.38	662.62				675.27				671.96		
1/22/2016 15:50			76.36	273.79	662.21				675.27				672.02		
1/22/2016 16:50			76.35	273.37	662.63				675.28				671.96		
1/22/2016 17:50			76.35	273.32	662.68				675.28				672.14		
1/22/2016 18:50			76.36	273.74	662.26				675.28				671.61		
1/22/2016 19:50			76.35	273.81	662.19				675.29				671.81		
1/22/2016 20:50			76.36	273.40	662.60				675.27				671.91		
1/22/2016 21:50			76.36	273.43	662.58				675.24				671.83		
1/22/2016 22:50			76.35	273.43	662.57				675.21				671.78		
1/22/2016 23:50			76.35	273.45	662.55				675.18				671.79		

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/23/2016 0:50			76.36	273.38	662.62				675.16				671.83		
1/23/2016 1:50			76.36	273.81	662.19				675.15				671.83		
1/23/2016 2:50			76.36	273.74	662.26				675.19				672.04		
1/23/2016 3:50			76.36	273.70	662.30				675.21				672.11		
1/23/2016 4:50			76.34	273.26	662.75				675.24				672.24		
1/23/2016 5:50			76.35	273.17	662.83				675.25				672.22		
1/23/2016 6:50			76.37	273.60	662.40				675.27				672.18		
1/23/2016 7:50			76.35	273.21	662.79				675.26				672.33		
1/23/2016 8:50			76.37	273.23	662.78				675.28				672.25		
1/23/2016 9:50			76.35	273.68	662.32				675.27				672.20		
1/23/2016 10:50			76.35	273.66	662.34				675.23				671.78		
1/23/2016 11:50			76.35	273.19	662.81				675.21				672.00		
1/23/2016 12:50			76.36	273.58	662.42				675.18				672.12		
1/23/2016 13:50			76.34	273.11	662.89				675.18				672.07		
1/23/2016 14:50			76.34	273.45	662.55				675.21				671.99		
1/23/2016 15:50			76.32	273.44	662.56				675.20				671.89		
1/23/2016 16:50			76.34	273.00	663.00				675.21				671.82		
1/23/2016 17:50			76.34	273.38	662.62				675.22				671.78		
1/23/2016 18:50			76.35	273.35	662.65				675.23				671.74		
1/23/2016 19:50			76.33	273.39	662.61				675.21				671.69		
1/23/2016 20:50			76.34	273.01	662.99				675.19				671.52		
1/23/2016 21:50			76.35	272.98	663.02				675.18				671.66		
1/23/2016 22:50			76.37	273.43	662.57				675.14				671.52		
1/23/2016 23:50			76.36	273.41	662.59				675.10				671.42		
1/24/2016 0:50			76.35	272.99	663.01				675.09				671.35		
1/24/2016 1:50			76.34	272.94	663.07				675.08				671.40		
1/24/2016 2:50			76.35	273.31	662.69				675.12				671.49		
1/24/2016 3:50			76.36	273.34	662.66				675.11				671.56		

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/24/2016 4:50			76.36	273.23	662.77				675.14				671.57		
1/24/2016 5:50			76.36	273.24	662.76				675.13				671.50		
1/24/2016 6:50			76.35	272.77	663.23				675.19				671.65		
1/24/2016 7:50			76.37	273.21	662.79				675.19				671.60		
1/24/2016 8:50			76.35	272.78	663.22				675.21				671.55		
1/24/2016 9:50			76.36	273.20	662.80				675.15				671.52		
1/24/2016 10:50			76.36	273.21	662.79				675.16				671.67		
1/24/2016 11:50			76.35	273.16	662.84				675.14				671.82		
1/24/2016 12:50			76.36	273.14	662.86				675.09				671.78		
1/24/2016 13:50			76.36	272.62	663.38				675.11				671.79		
1/24/2016 14:50			76.36	273.03	662.97				675.10				671.99		
1/24/2016 15:50			76.36	272.60	663.41				675.12				671.97		
1/24/2016 16:50			76.36	272.47	663.53				675.16				671.51		
1/24/2016 17:50			76.36	272.51	663.49				675.17				671.74		
1/24/2016 18:50			76.35	272.41	663.59				675.15				671.75		
1/24/2016 19:50			76.36	272.49	663.51				675.17				671.96		
1/24/2016 20:50			76.36	272.54	663.46				675.19				671.87		
1/24/2016 21:50			76.35	272.57	663.43				675.17				671.91		
1/24/2016 22:50			76.36	273.01	662.99				675.09				672.05		
1/24/2016 23:50			76.36	273.02	662.98				675.11				671.96		
1/25/2016 0:50			76.37	272.98	663.02				675.07				672.08		
1/25/2016 1:50			76.38	273.01	662.99				675.07				672.05		
1/25/2016 2:50			76.38	272.92	663.08				675.07				672.27		
1/25/2016 3:50			76.36	272.48	663.52				675.08				672.27		
1/25/2016 4:50			76.36	272.83	663.17				675.11				672.34		
1/25/2016 5:50			76.37	272.89	663.11				675.13				672.41		
1/25/2016 6:50			76.39	272.44	663.56				675.15				672.43		
1/25/2016 7:50			76.39	272.42	663.58				675.17				672.28		

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/25/2016 8:50			76.38	272.37	663.63				675.18				672.51		
1/25/2016 9:50			76.38	272.89	663.11				675.21				672.47		
1/25/2016 10:20	0		76.39	272.91	663.09	0.00			675.22	0.00			672.30	0.00	Pump Start
1/25/2016 10:21	1		76.39	283.30	652.71	10.38	560	53.93	675.21	0.01					Meter: 50,120 gallons
1/25/2016 10:22	2		76.39	283.82	652.18	10.91			675.22	0.01					Drawdown based on static water level prior to starting pump
1/25/2016 10:23	3		76.38	284.21	651.79	11.30	555	49.14	675.20	0.02					
1/25/2016 10:24	4		76.36	284.23	651.77	11.32			675.20	0.02					
1/25/2016 10:25	5		76.35	284.49	651.51	11.58	550	47.50	675.20	0.03					
1/25/2016 10:26	6		76.34	284.60	651.40	11.69			675.18	0.04					
1/25/2016 10:27	7		76.33	284.61	651.39	11.70			675.18	0.04					
1/25/2016 10:28	8		76.31	284.41	651.59	11.50			675.23	0.00					
1/25/2016 10:29	9		76.30	284.53	651.47	11.62			675.20	0.02					
1/25/2016 10:30	10		76.29	284.69	651.31	11.78	550	46.71	675.18	0.04			672.47	-0.17	
1/25/2016 10:31	11		76.28	284.47	651.53	11.56			675.19	0.03					
1/25/2016 10:32	12		76.25	284.69	651.31	11.78			675.19	0.03					
1/25/2016 10:33	13		76.23	284.81	651.19	11.90			675.21	0.01					
1/25/2016 10:34	14		76.20	284.79	651.21	11.88			675.22	0.00					
1/25/2016 10:35	15		76.18	284.85	651.15	11.94	550	46.06	675.20	0.03					
1/25/2016 10:40	20		76.11	285.04	650.96	12.13	550	45.35	675.19	0.03			672.47	-0.17	
1/25/2016 10:45	25		76.05	285.38	650.62	12.47	550	44.10	675.20	0.02					
1/25/2016 10:50	30		75.99	285.10	650.90	12.19	550	45.12	675.17	0.06			672.51	-0.21	
1/25/2016 11:05	45		75.91	285.45	650.55	12.54	550	43.88	675.20	0.03					
1/25/2016 11:20	60		75.85	285.87	650.13	12.96	550	42.44	675.19	0.03			672.47	-0.17	
1/25/2016 11:35	75		75.82	285.91	650.09	13.00	550	42.31	675.18	0.04					
1/25/2016 11:50	90		75.84	286.29	649.71	13.38	550	41.11	675.17	0.06			672.45	-0.15	
1/25/2016 12:05	105		75.81	286.43	649.57	13.52	550	40.68	675.18	0.04					
1/25/2016 12:20	120		75.80	285.94	650.07	13.02	550	42.23	675.16	0.06			672.44	-0.14	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/25/2016 13:20	180		75.83	287.14	648.86	14.23			675.15	0.07			672.44	-0.14	
1/25/2016 14:20	240		75.84	287.50	648.51	14.58			675.14	0.08			672.23	0.07	
1/25/2016 15:20	300		75.85	287.97	648.03	15.06	550		675.17	0.06			672.41	-0.11	
1/25/2016 16:20	360		75.88	288.81	647.19	15.90	550		675.16	0.06			672.34	-0.04	
1/25/2016 17:20	420		75.91	288.88	647.12	15.97			675.21	0.01			672.31	-0.01	
1/25/2016 18:20	480		75.93	289.10	646.90	16.19			675.18	0.04			672.16	0.14	
1/25/2016 19:20	540		75.96	289.79	646.21	16.88			675.25	-0.03			672.09	0.21	
1/25/2016 20:20	600		75.99	290.38	645.62	17.47			675.24	-0.02			671.88	0.42	
1/25/2016 21:20	660		76.03	290.46	645.54	17.55			675.21	0.01			671.71	0.59	
1/25/2016 22:20	720		76.05	291.33	644.67	18.42			675.23	-0.01			671.48	0.82	
1/25/2016 23:20	780		76.08	291.63	644.37	18.72			675.20	0.02			671.38	0.92	
1/26/2016 0:20	840		76.12	292.13	643.87	19.22			675.16	0.06			671.35	0.95	
1/26/2016 1:20	900		76.15	292.34	643.66	19.43			675.16	0.06			671.17	1.13	
1/26/2016 2:20	960		76.18	292.56	643.44	19.65			675.16	0.07			671.00	1.31	
1/26/2016 3:20	1020		76.22	292.97	643.03	20.06			675.15	0.07			670.87	1.43	
1/26/2016 4:20	1080		76.25	293.27	642.73	20.36			675.18	0.04			670.70	1.60	
1/26/2016 5:20	1140		76.27	293.69	642.31	20.78			675.19	0.03			670.35	1.95	
1/26/2016 6:20	1200		76.30	294.03	641.97	21.12			675.24	-0.02			670.37	1.93	
1/26/2016 7:20	1260		76.34	293.84	642.16	20.93			675.27	-0.05			670.17	2.13	
1/26/2016 8:20	1320		76.37	294.56	641.44	21.65			675.28	-0.06			670.11	2.19	
1/26/2016 9:20	1380		76.39	294.59	641.41	21.68			675.31	-0.08			669.72	2.58	
1/26/2016 10:20	1440		76.41	295.11	640.89	22.20			675.32	-0.10			669.66	2.64	
1/26/2016 11:20	1500		76.43	295.42	640.58	22.51			675.27	-0.05			669.50	2.80	
1/26/2016 12:20	1560		76.45	295.68	640.33	22.76			675.25	-0.03			669.20	3.10	
1/26/2016 13:20	1620		76.49	295.56	640.44	22.65			675.26	-0.04			669.09	3.22	
1/26/2016 14:20	1680		76.51	296.16	639.84	23.25	545	23.44	675.21	0.01			669.01	3.29	
1/26/2016 15:20	1740		76.56	296.29	639.71	23.38			675.23	0.00			668.73	3.57	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/26/2016 16:20	1800		76.58	296.08	639.92	23.17			675.24	-0.02	660.57	4.05	668.74	3.56	Start of Catfish Pond Well transducer - drawdown based on static from 1/21/2016
1/26/2016 17:20	1860		76.61	296.33	639.68	23.41			675.24	-0.01	660.46	4.16	668.61	3.69	
1/26/2016 18:20	1920		76.63	296.66	639.34	23.75			675.25	-0.03	660.30	4.32	668.47	3.83	
1/26/2016 19:20	1980		76.66	296.98	639.02	24.07			675.29	-0.07	660.17	4.45	668.28	4.02	
1/26/2016 20:20	2040		76.68	297.44	638.56	24.53			675.30	-0.08	659.99	4.63	668.14	4.16	
1/26/2016 21:20	2100		76.69	297.55	638.45	24.64			675.33	-0.10	659.85	4.77	667.97	4.33	
1/26/2016 22:20	2160		76.74	297.84	638.16	24.93			675.27	-0.05	659.69	4.93	667.59	4.71	
1/26/2016 23:20	2220		76.75	297.56	638.44	24.65			675.23	-0.01	659.48	5.14	667.60	4.70	
1/27/2016 0:20	2280		76.79	297.80	638.20	24.89			675.21	0.01	659.22	5.40	666.86	5.44	
1/27/2016 1:20	2340		76.80	298.56	637.44	25.65			675.17	0.05	659.01	5.61	667.12	5.18	
1/27/2016 2:20	2400		76.83	298.52	637.48	25.61			675.16	0.06	658.85	5.77	666.99	5.32	
1/27/2016 3:20	2460		76.86	298.87	637.13	25.96			675.14	0.08	658.70	5.92	666.92	5.38	
1/27/2016 4:20	2520		76.88	299.08	636.92	26.17			675.17	0.06	658.54	6.08	666.82	5.48	
1/27/2016 5:20	2580		76.91	299.31	636.69	26.40			675.16	0.07	658.42	6.20	666.70	5.60	
1/27/2016 6:20	2640		76.93	299.28	636.72	26.37			675.16	0.06	658.31	6.31	666.27	6.03	
1/27/2016 7:20	2700		76.95	299.77	636.23	26.86			675.17	0.05	658.14	6.48	666.16	6.15	
1/27/2016 8:20	2760		76.98	299.96	636.04	27.05			675.16	0.06	657.99	6.63	666.02	6.28	
1/27/2016 9:20	2820		77.00	299.75	636.25	26.84			675.17	0.05	657.80	6.82	665.83	6.47	
1/27/2016 10:20	2880		77.03	300.11	635.89	27.20			675.13	0.09	657.57	7.05	665.93	6.37	
1/27/2016 11:20	2940		77.04	300.39	635.61	27.48			675.08	0.14	657.29	7.33	665.65	6.65	
1/27/2016 12:20	3000		77.06	300.24	635.76	27.33			675.06	0.17	656.99	7.63	665.73	6.57	
1/27/2016 13:20	3060		77.09	300.88	635.12	27.97			675.00	0.22	656.78	7.84	665.62	6.68	
1/27/2016 14:20	3120		77.09	300.79	635.21	27.88			674.96	0.26	656.49	8.13	665.53	6.77	
1/27/2016 15:20	3180		77.11	301.11	634.89	28.20			674.91	0.31	656.25	8.37	665.31	6.99	
1/27/2016 16:20	3240		77.14	301.30	634.70	28.39	545	19.33	674.91	0.31	656.06	8.56	665.21	7.09	
1/27/2016 17:20	3300		77.15	301.72	634.28	28.81			674.88	0.34	655.84	8.78	665.10	7.20	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/27/2016 18:20	3360		77.16	301.50	634.50	28.59			674.88	0.34	655.65	8.97	664.96	7.34	
1/27/2016 19:20	3420		77.18	301.50	634.50	28.59			674.89	0.33	655.47	9.15	664.79	7.51	
1/27/2016 20:20	3480		77.21	301.52	634.49	28.60			674.84	0.38	655.25	9.37	664.56	7.74	
1/27/2016 21:20	3540		77.23	302.00	634.00	29.09			674.83	0.39	655.09	9.53	664.40	7.90	
1/27/2016 22:20	3600		77.24	302.03	633.98	29.11			674.78	0.44	654.86	9.76	664.21	8.09	
1/27/2016 23:20	3660		77.29	302.36	633.64	29.45			674.72	0.50	654.65	9.97	664.29	8.01	
1/28/2016 0:20	3720		77.30	302.54	633.46	29.63			674.68	0.54	654.47	10.15	664.13	8.17	
1/28/2016 1:20	3780		77.32	302.58	633.42	29.67			674.63	0.59	654.28	10.34	664.03	8.27	
1/28/2016 2:20	3840		77.34	302.56	633.44	29.65			674.56	0.66	654.08	10.54	663.93	8.37	
1/28/2016 3:20	3900		77.37	302.47	633.53	29.56			674.51	0.71	654.03	10.59	663.75	8.55	
1/28/2016 4:20	3960		77.40	302.70	633.30	29.79			674.50	0.72	654.00	10.63	663.57	8.73	
1/28/2016 5:20	4020		77.39	302.54	633.46	29.63			674.45	0.77	653.90	10.72	663.53	8.77	
1/28/2016 6:20	4080		77.41	303.19	632.82	30.27			674.40	0.82	653.87	10.75	663.41	8.89	
1/28/2016 7:20	4140		77.44	303.08	632.93	30.16			674.41	0.82	653.81	10.82	663.21	9.09	
1/28/2016 8:20	4200		77.44	303.59	632.41	30.68			674.35	0.88	653.75	10.87	663.06	9.24	
1/28/2016 9:20	4260		77.48	303.82	632.18	30.91			674.32	0.90	653.68	10.94	662.81	9.49	
1/28/2016 10:20	4320		77.49	303.57	632.43	30.66			674.26	0.97	653.59	11.03	662.86	9.44	
1/28/2016 11:20	4380		77.51	303.55	632.45	30.64			674.22	1.00	653.53	11.09	662.76	9.54	
1/28/2016 12:20	4440		77.53	303.77	632.23	30.86			674.16	1.06	653.39	11.23	662.60	9.70	
1/28/2016 13:20	4500		77.54	303.69	632.32	30.77			674.07	1.15	653.23	11.39	662.56	9.75	
1/28/2016 14:20	4560		77.59	304.19	631.81	31.28	544	17.39	674.02	1.20	653.12	11.51	662.51	9.79	
1/28/2016 15:20	4620		77.61	304.51	631.49	31.60			673.95	1.27	652.99	11.63	662.21	10.09	
1/28/2016 16:20	4680		77.61	304.50	631.50	31.59			673.89	1.33	652.86	11.76	662.34	9.96	
1/28/2016 17:20	4740		77.61	304.76	631.24	31.85			673.85	1.37	652.82	11.80	662.23	10.07	
1/28/2016 18:20	4800		77.65	304.53	631.47	31.62			673.82	1.40	652.71	11.91	661.90	10.40	
1/28/2016 19:20	4860		77.66	305.08	630.92	32.17			673.77	1.45	652.66	11.96	661.91	10.39	
1/28/2016 20:20	4920		77.67	304.76	631.24	31.85			673.73	1.49	652.58	12.04	661.92	10.38	
1/28/2016 21:20	4980		77.69	304.71	631.29	31.80			673.70	1.52	652.52	12.10	661.86	10.45	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/28/2016 22:20	5040		77.71	305.08	630.92	32.17			673.66	1.56	652.41	12.21	661.55	10.76	
1/28/2016 23:20	5100		77.71	305.54	630.46	32.63			673.59	1.63	652.33	12.29	661.64	10.67	
1/29/2016 0:20	5160		77.73	305.05	630.95	32.14			673.53	1.69	652.25	12.37	661.55	10.76	
1/29/2016 1:20	5220		77.76	305.69	630.31	32.78			673.47	1.76	652.16	12.47	661.49	10.81	
1/29/2016 2:20	5280		77.78	305.50	630.50	32.59			673.42	1.81	652.01	12.61	661.47	10.83	
1/29/2016 3:20	5340		77.77	305.58	630.42	32.67			673.33	1.89	651.90	12.72	661.31	10.99	
1/29/2016 4:20	5400		77.79	305.95	630.05	33.04			673.28	1.94	651.80	12.82	661.25	11.05	
1/29/2016 5:20	5460		77.81	305.70	630.30	32.79			673.22	2.01	651.71	12.91	661.18	11.12	
1/29/2016 6:20	5520		77.83	306.09	629.91	33.18			673.22	2.00	651.61	13.01	661.09	11.21	
1/29/2016 7:20	5580		77.82	306.18	629.82	33.27			673.15	2.07	651.57	13.05	660.95	11.35	
1/29/2016 8:20	5640		77.84	306.29	629.71	33.38			673.12	2.10	651.51	13.11	660.86	11.44	
1/29/2016 9:20	5700		77.88	305.90	630.11	32.98			673.09	2.13	651.41	13.21	660.25	12.05	
1/29/2016 10:20	5760		77.87	306.43	629.57	33.52			673.06	2.16	651.37	13.25	659.88	12.43	
1/29/2016 11:20	5820		77.89	306.08	629.92	33.17	544	16.40	672.99	2.23	651.26	13.36	659.42	12.88	
1/29/2016 12:20	5880		77.93	306.67	629.33	33.76			672.92	2.30	651.14	13.48	659.18	13.12	
1/29/2016 13:20	5940		77.92	306.32	629.68	33.41			672.87	2.36	651.00	13.62	658.94	13.36	
1/29/2016 14:20	6000		77.93	306.64	629.36	33.73			672.78	2.45	650.85	13.77	658.75	13.55	
1/29/2016 15:20	6060		77.96	307.19	628.81	34.28			672.73	2.49	650.71	13.91	658.64	13.66	
1/29/2016 16:20	6120		77.96	307.10	628.90	34.19			672.67	2.55	650.61	14.01	658.89	13.41	
1/29/2016 17:20	6180		77.95	306.87	629.13	33.96			672.61	2.61	650.51	14.11	659.38	12.92	
1/29/2016 18:20	6240		77.97	307.15	628.85	34.24			672.57	2.65	650.39	14.23	659.60	12.70	
1/29/2016 19:20	6300		78.00	306.99	629.01	34.08			672.54	2.69	650.31	14.31	659.57	12.73	
1/29/2016 20:20	6360		78.00	307.31	628.69	34.40			672.48	2.75	650.26	14.36	659.58	12.72	
1/29/2016 21:20	6420		78.03	307.68	628.32	34.77			672.45	2.77	650.12	14.50	659.59	12.71	
1/29/2016 22:20	6480		78.04	307.62	628.38	34.71			672.38	2.84	650.08	14.54	659.75	12.55	
1/29/2016 23:20	6540		78.04	307.49	628.52	34.57			672.33	2.89	649.99	14.63	659.63	12.67	
1/30/2016 0:20	6600		78.07	307.58	628.42	34.67			672.26	2.96	649.90	14.72	659.53	12.77	
1/30/2016 1:20	6660		78.11	307.64	628.36	34.73			672.20	3.02	649.82	14.80	659.51	12.79	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/30/2016 2:20	6720		78.09	307.92	628.08	35.01			672.15	3.07	649.68	14.94	659.57	12.73	
1/30/2016 3:20	6780		78.13	307.80	628.20	34.89			672.11	3.11	649.55	15.07	659.22	13.08	
1/30/2016 4:20	6840		78.11	307.89	628.11	34.98			672.02	3.21	649.44	15.18	659.43	12.87	
1/30/2016 5:20	6900		78.13	308.24	627.76	35.33			671.97	3.25	649.40	15.23	659.30	13.01	
1/30/2016 6:20	6960		78.16	308.33	627.68	35.41			671.89	3.33	649.36	15.26	659.04	13.26	
1/30/2016 7:20	7020		78.16	308.44	627.56	35.53			671.87	3.35	649.29	15.33	659.07	13.23	
1/30/2016 8:20	7080		78.18	308.04	627.96	35.13			671.87	3.35	649.21	15.41	659.04	13.26	
1/30/2016 9:20	7140		78.22	308.69	627.31	35.78			671.82	3.41	649.13	15.49	658.93	13.38	
1/30/2016 10:20	7200		78.21	308.64	627.37	35.72			671.74	3.48	649.09	15.53	659.00	13.31	
1/30/2016 11:03	7243	0	78.22	308.24	627.76	35.33	544	15.40	671.71	3.51	649.05	15.57			Pump Stop
1/30/2016 11:04	7244	1	78.22	297.62	638.38	24.71			671.72	3.51	649.03	15.59			Meter: 3,989,590 gallons
1/30/2016 11:05	7245	2	78.20	297.41	638.60	24.49			671.72	3.51	649.03	15.59			Total Volume Pumped: 3,939,470 gallons
1/30/2016 11:06	7246	3	78.18	296.83	639.17	23.92			671.73	3.49	649.03	15.59			
1/30/2016 11:07	7247	4	78.18	297.11	638.89	24.20			671.69	3.53	649.06	15.56			
1/30/2016 11:08	7248	5	78.19	296.97	639.03	24.06			671.72	3.50	649.03	15.59			
1/30/2016 11:09	7249	6	78.16	297.12	638.88	24.21			671.70	3.52	649.03	15.59			
1/30/2016 11:10	7250	7	78.12	297.19	638.81	24.28			671.71	3.52	649.01	15.61	658.98	13.32	
1/30/2016 11:11	7251	8	78.11	296.63	639.37	23.72			671.72	3.50	649.03	15.59			
1/30/2016 11:12	7252	9	78.11	296.64	639.36	23.73			671.69	3.53	649.03	15.59			
1/30/2016 11:13	7253	10	78.12	296.56	639.44	23.65			671.69	3.54	649.00	15.62			
1/30/2016 11:14	7254	11	78.15	296.49	639.51	23.58			671.71	3.51	649.01	15.61			
1/30/2016 11:15	7255	12	78.17	296.83	639.18	23.91			671.69	3.53	649.04	15.58			
1/30/2016 11:16	7256	13	78.23	296.82	639.18	23.91			671.71	3.51	649.01	15.61			
1/30/2016 11:17	7257	14	78.27	296.44	639.56	23.53			671.73	3.49	649.01	15.61			
1/30/2016 11:18	7258	15	78.30	296.44	639.56	23.53			671.69	3.53	649.01	15.61			
1/30/2016 11:23	7263	20	78.72	296.23	639.77	23.32			671.72	3.50	648.99	15.64	658.91	13.39	
1/30/2016 11:28	7268	25	79.09	296.50	639.51	23.58			671.68	3.54	649.03	15.59			

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Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/30/2016 11:33	7273	30	79.28	296.45	639.55	23.54			671.67	3.55	649.00	15.62	658.78	13.52	
1/30/2016 11:48	7288	45	79.80	295.96	640.05	23.04			671.67	3.55	648.93	15.69			
1/30/2016 12:03	7303	60	79.78	295.91	640.09	23.00			671.63	3.59	648.90	15.72	658.77	13.53	
1/30/2016 12:18	7318	75	79.71	295.36	640.65	22.44			671.65	3.57	648.90	15.72			
1/30/2016 12:33	7333	90	79.55	295.54	640.46	22.63			671.63	3.60	648.89	15.73	658.75	13.55	
1/30/2016 12:48	7348	105	79.36	294.96	641.05	22.04			671.58	3.64	648.85	15.77			
1/30/2016 13:03	7363	120	79.33	294.84	641.16	21.93			671.57	3.65	648.84	15.78	658.79	13.51	
1/30/2016 14:03	7423	180	78.92	294.21	641.80	21.29			671.51	3.71	648.82	15.80	658.80	13.50	
1/30/2016 15:03	7483	240	78.65	294.13	641.87	21.22			671.42	3.80	648.81	15.81	658.82	13.48	
1/30/2016 16:03	7543	300	78.45	293.65	642.35	20.74			671.36	3.86	648.84	15.78	658.62	13.68	
1/30/2016 17:03	7603	360	78.23	293.31	642.69	20.40			671.31	3.91	648.90	15.72	658.69	13.61	
1/30/2016 18:03	7663	420	78.08	292.94	643.06	20.03			671.27	3.95	648.96	15.66	658.49	13.82	
1/30/2016 19:03	7723	480	77.95	292.60	643.40	19.69			671.23	3.99	649.08	15.54	658.73	13.58	
1/30/2016 20:03	7783	540	77.84	292.22	643.78	19.31			671.16	4.06	649.14	15.48	658.76	13.54	
1/30/2016 21:03	7843	600	77.74	291.54	644.47	18.62			671.12	4.10	649.25	15.37	658.79	13.51	
1/30/2016 22:03	7903	660	77.66	291.33	644.67	18.42			671.09	4.13	649.33	15.30	659.14	13.16	
1/30/2016 23:03	7963	720	77.57	291.00	645.00	18.09			671.04	4.19	649.46	15.16	659.12	13.19	
1/31/2016 0:03	8023	780	77.51	291.10	644.90	18.19			671.00	4.23	649.50	15.12	659.22	13.08	
1/31/2016 1:03	8083	840	77.45	290.93	645.07	18.02			670.91	4.31	649.54	15.08	659.50	12.80	
1/31/2016 2:03	8143	900	77.40	290.23	645.77	17.32			670.85	4.37	649.61	15.01	659.39	12.91	
1/31/2016 3:03	8203	960	77.35	289.97	646.03	17.06			670.78	4.44	649.69	14.94	659.60	12.70	
1/31/2016 4:03	8263	1020	77.30	289.76	646.24	16.85			670.71	4.51	649.76	14.86	659.73	12.58	
1/31/2016 5:03	8323	1080	77.27	289.59	646.41	16.68			670.71	4.51	649.88	14.74	659.78	12.52	
1/31/2016 6:03	8383	1140	77.23	289.35	646.65	16.44			670.67	4.55	650.02	14.60	659.93	12.37	
1/31/2016 7:03	8443	1200	77.20	289.53	646.47	16.62			670.62	4.60	650.12	14.50	660.08	12.22	
1/31/2016 8:03	8503	1260	77.16	289.29	646.71	16.38			670.57	4.65	650.25	14.37	660.07	12.23	
1/31/2016 9:03	8563	1320	77.13	289.21	646.79	16.30			670.53	4.70	650.33	14.29	660.23	12.08	
1/31/2016 10:03	8623	1380	77.11	288.98	647.02	16.07			670.46	4.76	650.47	14.15	660.30	12.00	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
1/31/2016 11:03	8683	1440	77.08	288.40	647.60	15.49			670.42	4.80	650.53	14.09	660.46	11.84	
1/31/2016 12:03	8743	1500	77.05	288.16	647.84	15.25			670.39	4.83	650.58	14.04	660.59	11.71	
1/31/2016 13:03	8803	1560	77.04	288.07	647.93	15.16			670.32	4.90	650.65	13.97	660.67	11.63	
1/31/2016 14:03	8863	1620	77.01	287.84	648.16	14.93			670.29	4.93	650.75	13.87	660.30	12.01	
1/31/2016 15:03	8923	1680	77.00	288.02	647.98	15.11			670.24	4.98	650.85	13.77	660.17	12.14	
1/31/2016 16:03	8983	1740	76.98	287.57	648.43	14.66			670.19	5.03	650.93	13.69	660.31	12.00	
1/31/2016 17:03	9043	1800	76.96	287.82	648.18	14.91			670.12	5.10	651.08	13.54	660.54	11.76	
1/31/2016 18:03	9103	1860	76.95	287.66	648.34	14.75			670.11	5.11	651.17	13.45	660.59	11.72	
1/31/2016 19:03	9163	1920	76.93	287.11	648.90	14.19			670.05	5.17	651.27	13.35	660.61	11.70	
1/31/2016 20:03	9223	1980	76.92	287.36	648.64	14.45			670.05	5.18	651.39	13.23	660.81	11.49	
1/31/2016 21:03	9283	2040	76.90	286.80	649.20	13.89			670.00	5.22	651.43	13.19	660.51	11.80	
1/31/2016 22:03	9343	2100	76.89	287.08	648.92	14.17			669.95	5.27	651.54	13.08	660.79	11.51	
1/31/2016 23:03	9403	2160	76.87	286.51	649.49	13.60			669.94	5.29	651.63	13.00	661.09	11.21	
2/1/2016 0:03	9463	2220	76.85	286.52	649.48	13.61			669.89	5.33	651.76	12.87	661.33	10.97	
2/1/2016 1:03	9523	2280	76.84	286.76	649.24	13.85			669.88	5.34	651.84	12.79	661.40	10.91	
2/1/2016 2:03	9583	2340	76.83	286.60	649.40	13.69			669.83	5.39	651.97	12.65	661.39	10.91	
2/1/2016 3:03	9643	2400	76.82	286.21	649.79	13.30			669.78	5.44	652.03	12.59	661.53	10.77	
2/1/2016 4:03	9703	2460	76.81	286.32	649.68	13.41			669.73	5.49	652.17	12.45	661.60	10.71	
2/1/2016 5:03	9763	2520	76.80	286.01	649.99	13.10			669.69	5.53	652.24	12.38	661.68	10.62	
2/1/2016 6:03	9823	2580	76.79	285.88	650.12	12.97			669.70	5.52	652.33	12.29	661.77	10.53	
2/1/2016 7:03	9883	2640	76.79	285.95	650.05	13.04			669.63	5.60	652.45	12.17	661.84	10.47	
2/1/2016 8:03	9943	2700	76.78	285.38	650.62	12.47			669.62	5.60	652.51	12.11	661.99	10.31	
2/1/2016 9:03	10003	2760	76.76	285.69	650.31	12.78			669.60	5.63	652.58	12.04	662.01	10.29	
2/1/2016 10:03	10063	2820	76.75	285.14	650.86	12.23			669.56	5.66	652.64	11.99	662.00	10.30	
2/1/2016 11:03	10123	2880	76.75	285.54	650.46	12.63			669.54	5.69	652.69	11.93	662.10	10.20	
2/1/2016 12:03	10183	2940	76.74	285.25	650.75	12.34			669.50	5.72	652.77	11.85	662.29	10.01	
2/1/2016 13:03	10243	3000	76.73	285.13	650.87	12.22			669.45	5.77	652.90	11.72	662.36	9.94	
2/1/2016 14:03	10303	3060	76.72	284.55	651.45	11.64			669.41	5.81	652.95	11.67	662.47	9.83	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/1/2016 15:03	10363	3120	76.72	284.48	651.52	11.57			669.37	5.85	652.99	11.63	662.49	9.81	
2/1/2016 16:03	10423	3180	76.71	284.35	651.65	11.44			669.36	5.86	653.09	11.53	662.58	9.72	
2/1/2016 17:03	10483	3240	76.71	284.57	651.43	11.66			669.27	5.95	653.15	11.47	662.68	9.63	
2/1/2016 18:03	10543	3300	76.70	284.05	651.95	11.14			669.27	5.96	653.24	11.38	662.68	9.63	
2/1/2016 19:03	10603	3360	76.69	284.43	651.57	11.52			669.25	5.97	653.26	11.36	662.42	9.88	
2/1/2016 20:03	10663	3420	76.68	284.35	651.65	11.44			669.23	5.99	653.33	11.29	662.55	9.75	
2/1/2016 21:03	10723	3480	76.68	284.23	651.77	11.32			669.23	6.00	653.43	11.19	662.65	9.65	
2/1/2016 22:03	10783	3540	76.67	283.79	652.21	10.88			669.23	6.00	653.50	11.12	662.76	9.54	
2/1/2016 23:03	10843	3600	76.67	283.74	652.26	10.83			669.23	5.99	653.64	10.98	663.00	9.30	
2/2/2016 0:03	10903	3660	76.66	284.03	651.97	11.12			669.25	5.97	653.76	10.86	663.04	9.26	
2/2/2016 1:03	10963	3720	76.65	283.97	652.03	11.06			669.23	5.99	653.84	10.78	663.19	9.11	
2/2/2016 2:03	11023	3780	76.65	283.46	652.54	10.55			669.24	5.98	653.93	10.69	663.09	9.21	
2/2/2016 3:03	11083	3840	76.64	283.35	652.65	10.44			669.22	6.01	654.03	10.59	663.39	8.92	
2/2/2016 4:03	11143	3900	76.65	283.30	652.70	10.39			669.23	5.99	654.14	10.48	663.47	8.83	
2/2/2016 5:03	11203	3960	76.64	283.18	652.83	10.26			669.21	6.01	654.20	10.42	663.44	8.86	
2/2/2016 6:03	11263	4020	76.63	283.15	652.85	10.24			669.22	6.01	654.28	10.34	663.58	8.72	
2/2/2016 7:03	11323	4080	76.64	283.10	652.90	10.19			669.19	6.03	654.36	10.26	663.66	8.64	
2/2/2016 8:03	11383	4140	76.63	283.43	652.57	10.52			669.22	6.01	654.47	10.15	663.76	8.55	
2/2/2016 9:03	11443	4200	76.63	282.95	653.05	10.04			669.19	6.03	654.57	10.05	663.81	8.49	
2/2/2016 10:03	11503	4260	76.62	283.23	652.77	10.32			669.22	6.00	654.65	9.97	663.71	8.59	
2/2/2016 11:03	11563	4320	76.62	283.17	652.83	10.26			669.19	6.03	654.73	9.89			
2/2/2016 12:03	11623	4380	76.61	283.07	652.93	10.16			669.18	6.05	654.73	9.89	664.30	8.00	
2/2/2016 13:03	11683	4440	76.61	282.97	653.03	10.06			669.16	6.07	654.77	9.85	664.05	8.25	
2/2/2016 14:03	11743	4500	76.60	282.86	653.14	9.95			669.17	6.05	654.83	9.79	664.17	8.13	
2/2/2016 15:03	11803	4560	76.60	282.39	653.61	9.48			669.16	6.06	654.87	9.76	664.25	8.05	
2/2/2016 16:03	11863	4620	76.59	282.30	653.70	9.39			669.15	6.07	654.91	9.71	664.30	8.01	
2/2/2016 17:03	11923	4680	76.59	282.65	653.36	9.73			669.15	6.07	655.02	9.60	664.61	7.69	
2/2/2016 18:03	11983	4740	76.59	282.24	653.76	9.33			669.14	6.08	655.06	9.56	664.78	7.52	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/2/2016 19:03	12043	4800	76.58	282.26	653.75	9.34			669.12	6.10	655.11	9.51	664.66	7.64	
2/2/2016 20:03	12103	4860	76.58	282.54	653.46	9.63			669.14	6.09	655.21	9.41	664.43	7.87	
2/2/2016 21:03	12163	4920	76.57	282.03	653.97	9.12			669.14	6.08	655.24	9.38	664.77	7.53	
2/2/2016 22:03	12223	4980	76.56	281.99	654.01	9.08			669.15	6.08	655.35	9.27	664.68	7.62	
2/2/2016 23:03	12283	5040	76.57	281.94	654.06	9.03			669.13	6.09	655.42	9.20	664.95	7.35	
2/3/2016 0:03	12343	5100	76.56	282.34	653.66	9.43			669.14	6.08	655.48	9.14	665.03	7.28	
2/3/2016 1:03	12403	5160	76.56	282.22	653.78	9.31			669.18	6.04	655.60	9.02	665.06	7.24	
2/3/2016 2:03	12463	5220	76.56	282.17	653.83	9.26			669.20	6.03	655.68	8.94	665.02	7.29	
2/3/2016 3:03	12523	5280	76.55	282.09	653.91	9.18			669.23	6.00	655.80	8.82	665.32	6.98	
2/3/2016 4:03	12583	5340	76.55	282.06	653.94	9.14			669.25	5.98	655.83	8.79	665.29	7.01	
2/3/2016 5:03	12643	5400	76.54	281.66	654.34	8.75			669.24	5.98	655.84	8.78	665.38	6.92	
2/3/2016 6:03	12703	5460	76.54	282.06	653.94	9.15			669.29	5.93	655.94	8.68	665.47	6.83	
2/3/2016 7:03	12763	5520	76.54	282.04	653.96	9.13			669.28	5.94	655.97	8.65	665.49	6.82	
2/3/2016 8:03	12823	5580	76.53	281.57	654.43	8.66			669.28	5.94	656.05	8.57	665.55	6.75	
2/3/2016 9:03	12883	5640	76.53	281.57	654.43	8.66			669.32	5.90	656.14	8.48	665.50	6.80	
2/3/2016 10:03	12943	5700	76.54	281.55	654.45	8.64			669.29	5.93	656.24	8.38	665.60	6.70	
2/3/2016 11:03	13003	5760	76.54	281.88	654.12	8.97			669.33	5.89	656.26	8.36	665.52	6.78	
2/3/2016 12:03	13063	5820	76.56	281.40	654.60	8.49			669.31	5.92	656.35	8.27	665.80	6.50	
2/3/2016 13:03	13123	5880	76.58	281.23	654.77	8.32			669.33	5.90	656.41	8.21	665.82	6.48	
2/3/2016 14:03	13183	5940	76.57	281.21	654.79	8.30			669.33	5.89	656.51	8.11	665.87	6.43	
2/3/2016 15:03	13243	6000	76.57	281.47	654.53	8.56			669.33	5.89	656.57	8.05	665.96	6.34	
2/3/2016 16:03	13303	6060	76.53	281.11	654.89	8.20			669.37	5.86	656.58	8.04	665.78	6.52	
2/3/2016 17:03	13363	6120	76.52	281.06	654.94	8.15			669.34	5.88	656.68	7.94	666.07	6.23	
2/3/2016 18:03	13423	6180	76.53	281.37	654.63	8.46			669.36	5.87	656.74	7.88	666.02	6.28	
2/3/2016 19:03	13483	6240	76.55	280.96	655.04	8.05			669.40	5.82	656.78	7.84	666.09	6.21	
2/3/2016 20:03	13543	6300	76.55	281.35	654.65	8.44			669.34	5.88	656.83	7.79	666.20	6.10	
2/3/2016 21:03	13603	6360	76.56	281.29	654.71	8.38			669.41	5.81	656.85	7.77	666.21	6.09	
2/3/2016 22:03	13663	6420	76.54	281.39	654.61	8.48			669.39	5.83	656.88	7.74	666.29	6.01	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/3/2016 23:03	13723	6480	76.54	281.34	654.66	8.43			669.39	5.84	656.93	7.69	666.00	6.30	
2/4/2016 0:03	13783	6540	76.53	281.27	654.73	8.36			669.40	5.82	657.02	7.60	666.31	5.99	
2/4/2016 1:03	13843	6600	76.53	280.78	655.22	7.87			669.45	5.77	657.08	7.54	666.48	5.82	
2/4/2016 2:03	13903	6660	76.54	281.17	654.83	8.26			669.49	5.73	657.13	7.49	666.55	5.75	
2/4/2016 3:03	13963	6720	76.52	281.10	654.90	8.19			669.53	5.69	657.22	7.40	666.55	5.75	
2/4/2016 4:03	14023	6780	76.53	280.58	655.42	7.67			669.54	5.68	657.27	7.35	666.60	5.70	
2/4/2016 5:03	14083	6840	76.51	280.56	655.44	7.65			669.56	5.66	657.31	7.31	666.58	5.72	
2/4/2016 6:03	14143	6900	76.52	280.93	655.07	8.02			669.59	5.64	657.39	7.23	666.54	5.76	
2/4/2016 7:03	14203	6960	76.52	280.93	655.07	8.01			669.61	5.61	657.43	7.19	666.71	5.59	
2/4/2016 8:03	14263	7020	76.50	280.94	655.06	8.03			669.61	5.61	657.45	7.17	666.72	5.58	
2/4/2016 9:03	14323	7080	76.51	280.89	655.11	7.98			669.61	5.62	657.54	7.08	666.72	5.59	
2/4/2016 10:03	14383	7140	76.50	280.87	655.13	7.96			669.63	5.59	657.54	7.08	666.74	5.56	
2/4/2016 11:03	14443	7200	76.50	280.80	655.20	7.89			669.66	5.56	657.54	7.08	666.56	5.74	
2/4/2016 12:03	14503	7260	76.51	280.31	655.69	7.40			669.64	5.58	657.56	7.06	666.78	5.52	
2/4/2016 13:03	14563	7320	76.50	280.63	655.37	7.72			669.67	5.55	657.62	7.01	666.47	5.83	
2/4/2016 14:03	14623	7380	76.51	280.53	655.47	7.62			669.66	5.57	657.71	6.91	666.56	5.74	
2/4/2016 15:03	14683	7440	76.52	280.48	655.52	7.57			669.69	5.53	657.76	6.86	666.70	5.60	
2/4/2016 16:03	14743	7500	76.53	280.46	655.54	7.55			669.70	5.52	657.78	6.84	666.80	5.50	
2/4/2016 17:03	14803	7560	76.53	280.37	655.63	7.46			669.70	5.52	657.82	6.80	666.93	5.37	
2/4/2016 18:03	14863	7620	76.54	279.88	656.12	6.97			669.71	5.51	657.87	6.75	666.95	5.35	
2/4/2016 19:03	14923	7680	76.53	280.32	655.68	7.41			669.73	5.49	657.91	6.72	666.83	5.47	
2/4/2016 20:03	14983	7740	76.53	279.90	656.10	6.99			669.75	5.47	657.96	6.66	666.94	5.36	
2/4/2016 21:03	15043	7800	76.53	279.90	656.10	6.99			669.73	5.50	657.94	6.68	666.98	5.32	
2/4/2016 22:03	15103	7860	76.54	279.89	656.11	6.98			669.77	5.45	657.93	6.69	666.93	5.37	
2/4/2016 23:03	15163	7920	76.54	279.75	656.26	6.83			669.74	5.48	657.92	6.70	666.88	5.43	
2/5/2016 0:03	15223	7980	76.53	279.79	656.21	6.88			669.77	5.45	657.99	6.63	667.02	5.28	
2/5/2016 1:03	15283	8040	76.53	280.10	655.90	7.19			669.78	5.44	658.05	6.57	667.08	5.22	
2/5/2016 2:03	15343	8100	76.54	279.62	656.38	6.71			669.82	5.41	658.13	6.49	667.06	5.24	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/5/2016 3:03	15403	8160	76.54	279.95	656.05	7.04			669.83	5.39	658.18	6.44	667.32	4.99	
2/5/2016 4:03	15463	8220	76.54	279.41	656.59	6.50			669.89	5.33	658.26	6.36	667.31	4.99	
2/5/2016 5:03	15523	8280	76.54	279.86	656.14	6.95			669.90	5.32	658.31	6.31	667.29	5.01	
2/5/2016 6:03	15583	8340	76.53	279.84	656.16	6.93			669.94	5.28	658.38	6.24	667.44	4.86	
2/5/2016 7:03	15643	8400	76.54	279.79	656.21	6.88			669.97	5.25	658.44	6.18	667.46	4.84	
2/5/2016 8:03	15703	8460	76.54	279.37	656.64	6.45			669.95	5.27	658.46	6.16	667.40	4.90	
2/5/2016 9:03	15763	8520	76.54	279.74	656.26	6.83			669.98	5.24	658.45	6.17	667.45	4.85	
2/5/2016 10:03	15823	8580	76.54	279.75	656.25	6.84			669.97	5.26	658.45	6.18	667.55	4.75	
2/5/2016 11:03	15883	8640	76.53	279.27	656.73	6.36			669.99	5.23	658.50	6.12	667.56	4.74	
2/5/2016 12:03	15943	8700	76.53	279.60	656.40	6.69			669.99	5.23	658.55	6.07	667.60	4.70	
2/5/2016 13:03	16003	8760	76.54	279.08	656.92	6.17			669.97	5.26	658.57	6.05	667.53	4.77	
2/5/2016 14:03	16063	8820	76.53	279.12	656.88	6.21			669.97	5.26	658.63	5.99	667.62	4.69	
2/5/2016 15:03	16123	8880	76.53	279.12	656.88	6.21			670.01	5.21	658.71	5.91	667.62	4.68	
2/5/2016 16:03	16183	8940	76.53	279.49	656.51	6.58			670.07	5.15	658.75	5.87	667.83	4.47	
2/5/2016 17:03	16243	9000	76.54	279.06	656.94	6.15			670.08	5.14	658.80	5.82	667.82	4.48	
2/5/2016 18:03	16303	9060	76.53	279.17	656.83	6.26			670.11	5.11	658.78	5.84	667.70	4.60	
2/5/2016 19:03	16363	9120	76.53	279.14	656.86	6.23			670.11	5.12	658.83	5.80	667.64	4.66	
2/5/2016 20:03	16423	9180	76.54	279.59	656.41	6.68			670.09	5.13	658.78	5.84	667.72	4.58	
2/5/2016 21:03	16483	9240	76.54	279.21	656.79	6.30			670.08	5.14	658.79	5.83	667.74	4.56	
2/5/2016 22:03	16543	9300	76.54	279.65	656.35	6.74			670.09	5.13	658.73	5.89	667.64	4.67	
2/5/2016 23:03	16603	9360	76.54	279.60	656.41	6.68			670.10	5.12	658.78	5.84	667.79	4.51	
2/6/2016 0:03	16663	9420	76.54	279.60	656.40	6.69			670.10	5.13	658.81	5.81	667.56	4.75	
2/6/2016 1:03	16723	9480	76.54	279.57	656.43	6.66			670.13	5.09	658.82	5.80	667.77	4.53	
2/6/2016 2:03	16783	9540	76.55	279.10	656.90	6.19			670.17	5.05	658.93	5.69	667.61	4.69	
2/6/2016 3:03	16843	9600	76.55	279.03	656.98	6.11			670.20	5.02	658.97	5.65	667.90	4.40	
2/6/2016 4:03	16903	9660	76.55	279.00	657.00	6.09			670.23	5.00	659.01	5.61	667.94	4.37	
2/6/2016 5:03	16963	9720	76.55	278.83	657.17	5.92			670.26	4.96	659.10	5.52	667.96	4.34	
2/6/2016 6:03	17023	9780	76.55	278.90	657.10	5.99			670.30	4.92	659.10	5.52	668.02	4.28	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/6/2016 7:03	17083	9840	76.55	279.30	656.70	6.39			670.33	4.90	659.07	5.55	667.99	4.32	
2/6/2016 8:03	17143	9900	76.55	279.20	656.80	6.29			670.32	4.91	659.09	5.53	668.00	4.31	
2/6/2016 9:03	17203	9960	76.55	278.81	657.19	5.90			670.33	4.89	659.10	5.52	668.00	4.31	
2/6/2016 10:03	17263	10020	76.55	279.30	656.70	6.39			670.34	4.88	659.14	5.48	668.01	4.29	
2/6/2016 11:03	17323	10080	76.55	279.20	656.80	6.29			670.33	4.89	659.19	5.43	667.69	4.61	
2/6/2016 12:03	17383	10140	76.54	278.84	657.16	5.93			670.34	4.89	659.22	5.40	667.23	5.07	
2/6/2016 13:03	17443	10200	76.54	278.78	657.22	5.87			670.34	4.88	659.25	5.37	667.48	4.82	
2/6/2016 14:03	17503	10260	76.55	278.63	657.37	5.72			670.35	4.87	659.23	5.39	667.65	4.65	
2/6/2016 15:03	17563	10320	76.55	279.10	656.90	6.19			670.40	4.83	659.23	5.39	667.79	4.51	
2/6/2016 16:03	17623	10380	76.55	278.63	657.37	5.72			670.42	4.81	659.26	5.36	667.87	4.43	
2/6/2016 17:03	17683	10440	76.55	278.57	657.44	5.65			670.43	4.79	659.29	5.33	667.13	5.17	
2/6/2016 18:03	17743	10500	76.55	278.45	657.55	5.54			670.44	4.78	659.31	5.31	667.75	4.55	
2/6/2016 19:03	17803	10560	76.55	278.96	657.04	6.05			670.46	4.76	659.32	5.30	667.84	4.46	
2/6/2016 20:03	17863	10620	76.55	279.00	657.00	6.09			670.44	4.78	659.35	5.27	667.97	4.33	
2/6/2016 21:03	17923	10680	76.55	278.61	657.40	5.69			670.44	4.78	659.34	5.28	667.84	4.46	
2/6/2016 22:03	17983	10740	76.55	278.95	657.05	6.04			670.40	4.82	659.37	5.25	667.42	4.88	
2/6/2016 23:03	18043	10800	76.55	278.96	657.04	6.05			670.41	4.81	659.39	5.23	667.97	4.33	
2/7/2016 0:03	18103	10860	76.55	278.91	657.09	6.00			670.35	4.87	659.39	5.23	668.11	4.19	
2/7/2016 1:03	18163	10920	76.54	278.44	657.56	5.53			670.42	4.81	659.39	5.24	667.91	4.39	
2/7/2016 2:03	18223	10980	76.55	278.81	657.19	5.90			670.42	4.80	659.43	5.19	667.32	4.99	
2/7/2016 3:03	18283	11040	76.55	278.65	657.35	5.74			670.48	4.74	659.47	5.16	668.05	4.25	
2/7/2016 4:03	18343	11100	76.55	278.24	657.76	5.33			670.47	4.76	659.60	5.02	668.13	4.17	
2/7/2016 5:03	18403	11160	76.55	278.61	657.39	5.70			670.51	4.71	659.62	5.00	668.20	4.11	
2/7/2016 6:03	18463	11220	76.55	278.06	657.95	5.14			670.52	4.70	659.68	4.94	668.25	4.05	
2/7/2016 7:03	18523	11280	76.55	278.51	657.49	5.59			670.55	4.67	659.73	4.89	668.38	3.93	
2/7/2016 8:03	18583	11340	76.55	278.08	657.92	5.17			670.57	4.65	659.74	4.88	668.40	3.90	
2/7/2016 9:03	18643	11400	76.55	278.00	658.00	5.08			670.58	4.64	659.77	4.86	666.93	5.37	
2/7/2016 10:03	18703	11460	76.55	278.05	657.95	5.14			670.54	4.68	659.80	4.82	667.30	5.01	

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/7/2016 11:03	18763	11520	76.54	277.97	658.03	5.06			670.57	4.65	659.81	4.82	667.50	4.80	
2/7/2016 12:03	18823	11580	76.55	278.02	657.98	5.11			670.52	4.70	659.81	4.81	667.59	4.71	
2/7/2016 13:03	18883	11640	76.54	277.84	658.16	4.93			670.54	4.69	659.79	4.83	667.90	4.40	
2/7/2016 14:03	18943	11700	76.54	278.28	657.72	5.37			670.53	4.70	659.76	4.86	668.03	4.27	
2/7/2016 15:03	19003	11760	76.55	278.11	657.90	5.19			670.54	4.68	659.77	4.85	667.98	4.32	
2/7/2016 16:03	19063	11820	76.54	277.71	658.29	4.80			670.60	4.62	659.79	4.83	668.04	4.26	
2/7/2016 17:03	19123	11880	76.54	277.68	658.32	4.77			670.64	4.58	659.84	4.78	668.10	4.20	
2/7/2016 18:03	19183	11940	76.54	278.06	657.94	5.15			670.67	4.56	659.85	4.77	668.01	4.29	
2/7/2016 19:03	19243	12000	76.55	277.65	658.36	4.73			670.64	4.58	659.89	4.73	667.82	4.48	
2/7/2016 20:03	19303	12060	76.54	277.64	658.36	4.73			670.67	4.55	659.87	4.75	668.01	4.30	
2/7/2016 21:03	19363	12120	76.55	278.09	657.91	5.18			670.67	4.56	659.88	4.74	667.88	4.42	
2/7/2016 22:03	19423	12180	76.54	277.71	658.29	4.80			670.63	4.60	659.89	4.73	668.17	4.13	
2/7/2016 23:03	19483	12240	76.55	277.69	658.31	4.77			670.63	4.59	659.90	4.73	667.96	4.34	
2/8/2016 0:03	19543	12300	76.54	278.10	657.90	5.19			670.65	4.58	659.89	4.73	668.29	4.01	
2/8/2016 1:03	19603	12360	76.54	277.65	658.35	4.74			670.67	4.55	659.94	4.68	668.29	4.01	
2/8/2016 2:03	19663	12420	76.54	277.57	658.43	4.66			670.68	4.55	659.99	4.63	668.28	4.02	
2/8/2016 3:03	19723	12480	76.54	278.02	657.99	5.10			670.72	4.50	660.03	4.59	668.50	3.80	
2/8/2016 4:03	19783	12540	76.54	277.60	658.40	4.69			670.76	4.46	660.08	4.55	668.52	3.78	
2/8/2016 5:03	19843	12600	76.54	277.98	658.03	5.06			670.81	4.41	660.15	4.48	668.66	3.65	
2/8/2016 6:03	19903	12660	76.54	277.95	658.05	5.04			670.85	4.38	660.17	4.45	668.65	3.65	
2/8/2016 7:03	19963	12720	76.54	277.52	658.48	4.61			670.88	4.35	660.25	4.37	668.78	3.52	
2/8/2016 8:03	20023	12780	76.54	277.96	658.04	5.05			670.93	4.29	660.29	4.33	668.84	3.46	
2/8/2016 9:03	20083	12840	76.53	277.95	658.05	5.04			670.93	4.29	660.29	4.33	668.36	3.94	
2/8/2016 10:03	20143	12900	76.54	277.53	658.47	4.62			670.94	4.28	660.31	4.31	668.86	3.45	
2/8/2016 11:03	20203	12960	76.54	277.57	658.43	4.66			670.93	4.29	660.34	4.28	668.87	3.44	
2/8/2016 12:03	20263	13020	76.54	277.56	658.44	4.65			670.90	4.32	660.40	4.23	668.84	3.46	
2/8/2016 12:29	20290	13047	76.55	277.88	658.12	4.97			670.91	4.32	660.42	4.20			
2/8/2016 13:09									670.91	4.31	660.44	4.18			

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Needmore Water, LLC. Well D - Aquifer Test (January 25, 2016)

Date and Time	Time Since Pump Start (min.)	Time Since Pump Stop (min.)	PW: Well D Temp. (F)	PW: Well D Water Level (ft.bgs)	PW: Well D Water Level (ft. MSL)	PW: Well D Draw-down (ft.)	Pump Rate (gpm)	Specific Capacity (gpm/ft.)	OW: Top of the Hill Well Water Level (ft. MSL)	OW: Top of the Hill Well Draw-down (ft.)	OW: Catfish Pond Well Water Level (ft. MSL)	OW: Catfish Pond Well Draw-down (ft.)	OW: Amos Well Water Level* (ft. MSL)	OW: Amos Well Draw-down* (ft.)	Comments
2/8/2016 14:01											660.46	4.16	668.97	3.33	
2/11/2016 14:00													669.15	3.15	
2/16/2016 12:45									672.82	2.40					Manual readings taken via e-line on 2/16/2016
2/16/2016 13:20					660.90	2.19									
2/16/2016 13:35											663.45	1.17			

Note: bgs = below ground surface; Column Pipe = 5-inch; Horsepower = 60 HP; MSL = Mean Sea Level; Pump Setting = 588 ft; *Amos Well water levels taken every 10 mins, nearest interval shown

Wet Rock Groundwater Services, LLC
Groundwater Specialists
317 Ranch Road 620 South, Suite 203
Austin, Texas 78734
Ph: 512.773.3226
www.wetrockgs.com

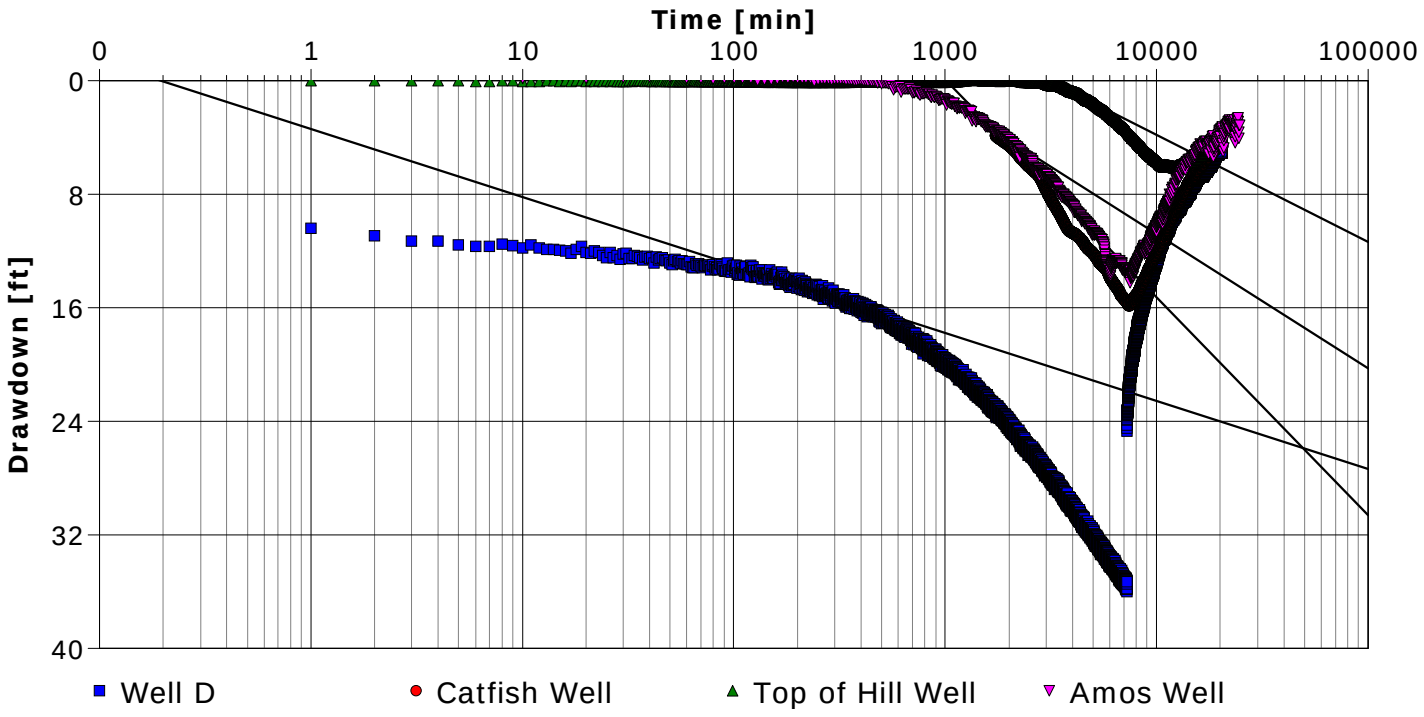
Pumping Test Analysis Report

Project: Well D Pump Test

Number: 079-001-15

Client: Needmore River Ranch

Location: Hays, County, Texas	Pumping Test: Well D	Pumping Well: Well D
Test Conducted by: BB		Test Date: 1/25/2016
Analysis Performed by: BWB	Cooper-Jacob	Analysis Date: 2/2/2016
Aquifer Thickness: 330.00 ft	Discharge: variable, average rate 544.23 [U.S. gal/min]	



Calculation using COOPER & JACOB

Observation Well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Storage coefficient	Radial Distance to PW [ft]	
Well D	4.00×10^{3}	1.21×10^{1}			
Catfish Well	1.25×10^{3}	3.79×10^{0}	6.03×10^{-5}	5717.44	
Top of Hill Well	2.55×10^{3}	7.71×10^{0}	2.20×10^{-4}	7522.83	
Amos Well	2.03×10^{3}	6.14×10^{0}	2.15×10^{-5}	10313.43	
Average	2.46×10^{3}	7.44×10^{0}	1.00×10^{-4}		

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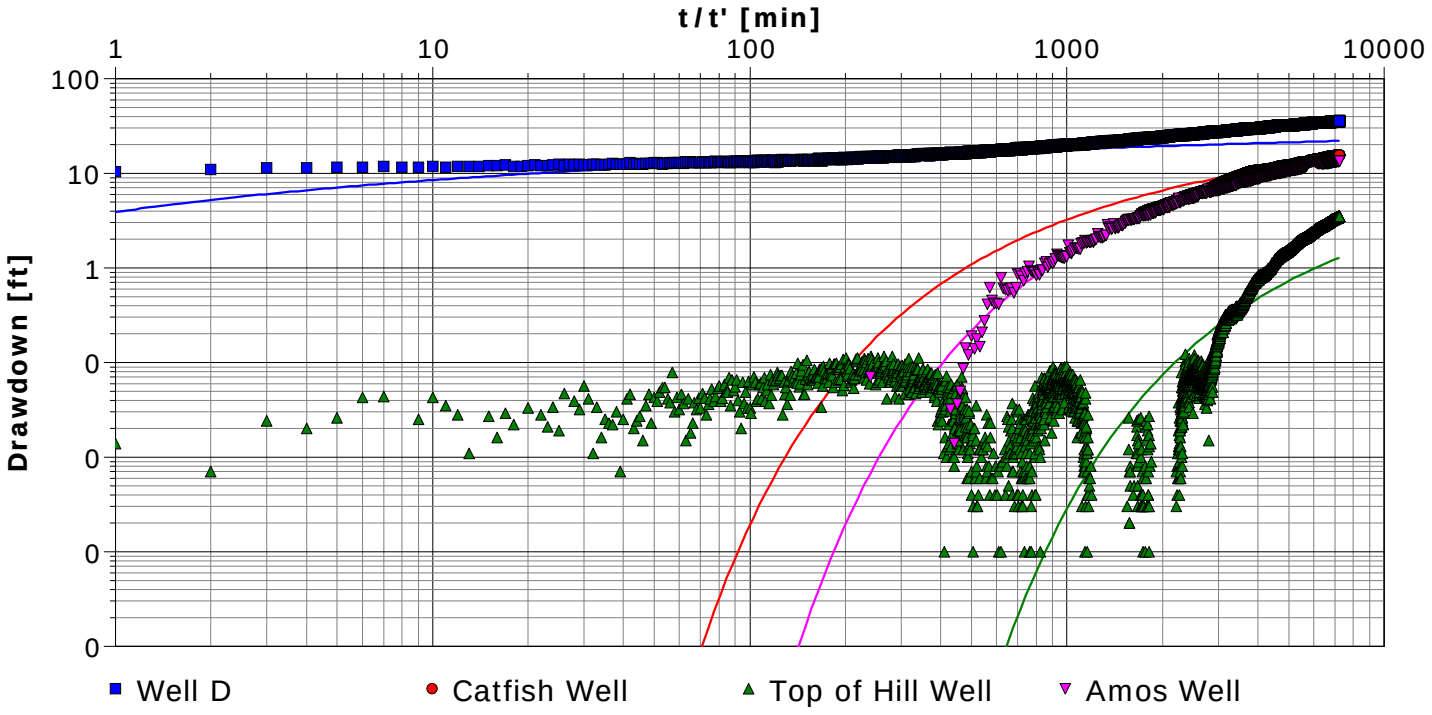
Pumping Test Analysis Report

Project: Well D Pump Test

Number: 079-001-15

Client: Needmore River Ranch

Location: Hays, County, Texas	Pumping Test: Well D	Pumping Well: Well D
Test Conducted by: BB		Test Date: 1/25/2016
Analysis Performed by: BB	Theis	Analysis Date: 2/17/2016
Aquifer Thickness: 330.00 ft	Discharge: variable, average rate 544.23 [U.S. gal/min]	



Calculation using Theis

Observation Well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Storage coefficient	Radial Distance to PW [ft]	
Well D	4.05×10^{3}	1.23×10^{1}			
Catfish Well	1.10×10^{3}	3.33×10^{0}	5.90×10^{-5}	5717.44	
Top of Hill Well	2.25×10^{3}	6.82×10^{0}	5.90×10^{-4}	7522.83	
Amos Well	8.00×10^{2}	2.42×10^{0}	2.75×10^{-5}	10313.43	
Average	2.05×10^{3}	6.21×10^{0}	2.26×10^{-4}		

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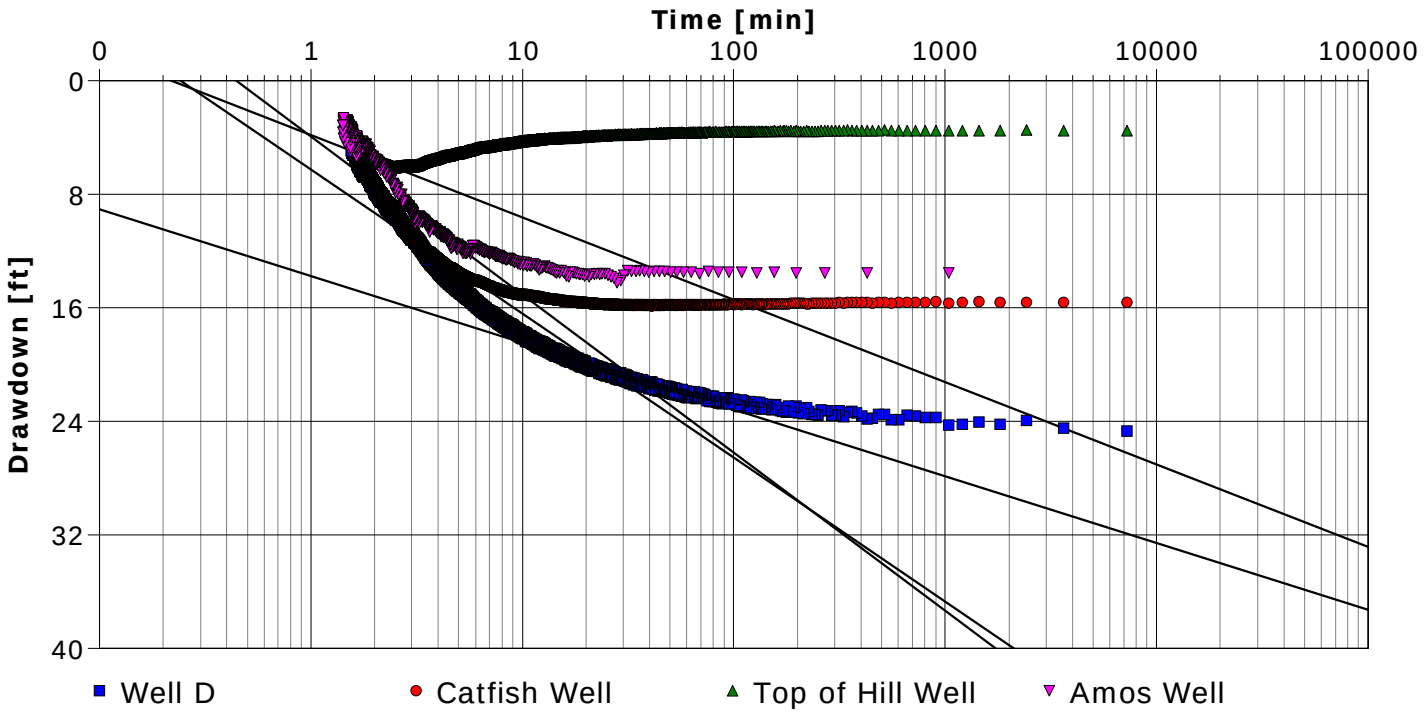
Pumping Test Analysis Report

Project: Well D Pump Test

Number: 079-001-15

Client: Needmore River Ranch

Location: Hays, County, Texas	Pumping Test: Well D	Pumping Well: Well D
Test Conducted by: BB		Test Date: 1/25/2016
Analysis Performed by: BB	Theis Recovery	Analysis Date: 2/16/2016
Aquifer Thickness: 330.00 ft	Discharge: variable, average rate 544.23 [U.S. gal/min]	



Calculation using THEIS & JACOB

Observation Well	Transmissivity [ft²/d]	Hydraulic Conductivity [ft/d]	Radial Distance to PW [ft]	
Well D	4.07×10^{3}	1.23×10^{1}		
Catfish Well	1.89×10^{3}	5.73×10^{0}	5717.44	
Top of Hill Well	3.31×10^{3}	1.00×10^{1}	7522.83	
Amos Well	1.72×10^{3}	5.22×10^{0}	10313.43	
Average	2.75×10^{3}	8.33×10^{0}		

Appendix I

Water Quality Report

Environmental Laboratory Services
The Solution Lab

LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)356-6022
Fax: (512)356-6021

ANALYTICAL RESULTS

Workorder: Q1604095

Lab ID: **Q1604095001** Date Received: 1/29/2016 14:11 Matrix: Aqueous
Sample ID: **WELL D** Date Collected: 1/29/2016 11:08 Sample Type: SAMPLE
Project ID: **WET ROCK WELL ANALYSIS**

Parameters	Results	Units	LOD	LOQ	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E200.7 Metals, Trace Elements	Preparation Method: E200.7 Prep Analytical Method: E200.7 Metals, Trace Elements										
Calcium Total	161	mg/L	0.0700	0.200		1	02/02/16	FM	02/04/16 13:41	MV	
Iron Total	0.256	mg/L	0.0200	0.0500		1	02/02/16	FM	02/04/16 13:41	MV	
Magnesium Total	83.7	mg/L	0.0700	0.200		1	02/02/16	FM	02/04/16 13:41	MV	
Potassium Total	8.74	mg/L	0.0700	0.200		1	02/02/16	FM	02/04/16 13:41	MV	
Sodium Total	29.5	mg/L	0.200	0.600		1	02/02/16	FM	02/04/16 13:41	MV	
ANIONS by ION CHROMATOGRAPHY											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Sulfate	507	mg/L	4.00	10.0		10	02/04/16 16:40	ML	02/04/16 16:40	ML	
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	30.0	mg/L	2.00	5.00		5	02/01/16 21:20	ML	02/01/16 21:20	ML	
Fluoride	1.76	mg/L	0.0200	0.0500		5	02/01/16 21:20	ML	02/01/16 21:20	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	1000	mg/L	25.0	25.0		10	02/03/16 08:23	JM	02/03/16 08:23	JM	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity	Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity										
Bicarbonate Alkalinity	277	mg/L	20.0	20.0		1	02/03/16	ADG	02/03/16	ADG	N
pH											
Analysis Desc: SM4500-H+B, pH	Preparation Method: SM4500-H+B, pH Analytical Method: SM4500-H+B, pH										
pH	7.49	pH	0.00	0.00		1	02/01/16	ADG	02/01/16	ADG	

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Austin, TX 78744
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ANALYTICAL RESULTS

Workorder: Q1604095

Lab ID: **Q1604095001**
Sample ID: **WELL D**
Project ID: **WET ROCK WELL ANALYSIS**

Date Received: 1/29/2016 14:11
Date Collected: 1/29/2016 11:08

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOD	LOQ	ML	DF	Prepared	By	Analyzed	By	Qual
Temperature	20.9	C				1	02/01/16	ADG	02/01/16	ADG	N

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ANALYTICAL RESULTS QUALIFIERS

Workorder: Q1604095

PARAMETER QUALIFIERS

Lab ID: Q1604095001

N	Not Accredited