ADVANCED GEOLOGICAL SERVICES

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October 8, 2012
AGS Ref.: 12-194-1

Mr. Steve Snyder
Groundwater Sciences Corporation
2601 Market Street, Suite 310-1
Harrisburg, Pennsylvania

Subject: Borehole Geophysical Investigation Results
Harley Davidson Site
York, Pennsylvania

Dear Mr. Snyder:

Advanced Geological Services (AGS) completed a borehole geophysical investigation for Groundwater Sciences Corporation on August 29-30, 2012 at the Harley Davidson Site in York, Pennsylvania. Geophysical data were collected in four monitoring wells that included CW-15, MW-2, MW-12, and MW-29. The wells was installed to depths of approximately 270 feet, 123 feet, 101 feet, and 60 feet, respectively. These wells were located at various locations throughout the site.

Objectives

The primary objective of this investigation was to locate potential water-bearing fracture zones in the well and to determine the structural orientation of these fractures. The borehole geophysical data provided information regarding the depth and vertical extent of fractures and fracture zones, the dip and azimuth of the fractures, and their relation to the local bedding characteristics.

Geophysical Equipment

AGS used four separate downhole instruments to complete the investigation. These included the Century Geophysical multitool (9041), which records natural gamma ray (GR), 64-inch normal resistivity (64N), 16-inch normal resistivity (16N), 40-inch lateral resistivity (40L), single-point resistance (SPR), fluid resistivity (FR), temperature (T), and differential temperature (DT) in a single run into the well. AGS also used a three-arm caliper to record a continuous log of borehole size, and an optical televiewer (OTV), which provided azimuth and dip information for fractures and bedding structures. Finally, AGS used a heat-pulse flowmeter at selected depth intervals to provide an indication of the flow direction of fluids within the borehole.

Borehole Geophysical Theory

Gamma Ray Logs

The natural gamma ray probe is a passive device that measures the amount (in counts per second, cps) of naturally-occurring gamma ray emissions that are discharged from sediment/rock units as the instrument is moved in the borehole. The primary objective of the gamma ray instrument is to provide diagnostic lithologic information within the well bore. Potassium, which contains about 0.012 per cent potassium-40, is abundant in feldspars and micas, which readily decompose to clay. Clays also concentrate the heavy radio-elements through the process of ion exchange and adsorption, and therefore exhibit a high gamma ray count during the logging operation. Shales contain a high percentage of clay materials and therefore exhibit high gamma ray responses, as well. Conversely, limestones, sandstones, and other common rock types that do not possess radio-elements within their matrix exhibit low gamma ray count rates. Typically, clay-filled fracture zones can be distinguished from the limestone host rock.

Electric Logs

The electrical resistivity (64-inch, 16-inch, normal devices, 40-inch lateral, and fluid resistivity device) and resistance (single point) measurements record the electrical characteristics (in ohm-meters and ohms, respectively) of the formations and fluids encountered in the borehole. Electrical currents are transmitted into the formations and the apparent electrical resistivity and resistance are determined for each device. The approximate depth of investigation varies for each device as the distance between transmitter and receiver vary. The investigation depths of penetration for the electrical resistivity devices are: 32 inches for the 64-inch normal log, 8 inches for the 16-inch normal log, 20 inches for the 40-inch lateral log, and 1 inch for the fluid resistivity log. The single-point resistance log penetrates several inches into the formation. Within a water-bearing fracture zone, it is typical that the logs exhibit a relative decrease in electrical resistivity and electrical resistance from the surrounding unfractured rocks. This is due to the presence of low-resistivity (or conductive) fluids into the measured area. The fluid resistivity log may exhibit subtle changes in slope that are due to the addition of formation waters whose bulk resistivity is different than borehole fluid bulk resistivity.

Temperature Logs

The temperature and differential temperature logs indicate variations in temperature with depth in the well. The temperature log simply measures the ambient temperature at each depth range (0.1 feet), while the differential temperature is the subtracted difference between

temperature measurements at each depth range. If formation fluids are entering the well through fractures or porous media, a temperature anomaly may be present that indicates their existence. A change in the slope of the temperature curve, or spiked responses from the differential temperature curve may indicate the entrance of formation waters into the well. In addition, the flow direction of the formation fluids may be determined by observing the character of the curves above, and below the fracture.

Caliper Log

The caliper log measures the diameter of the borehole as the instrument is raised in the well. The deviations in borehole size may indicate the presence of fractures, changes in lithology, and physical condition of the borehole walls. Typically, fractured zones are made up of weathered or semi-consolidated rocks, which loosen or break during the drilling process. Therefore, these zones typically exhibit an increase in borehole size.

Optical Televiewer Log

The optical televiewer log provides an oriented, high-resolution, 360-degree photographic image of the borehole. The oriented image of the borehole is presented in unwrapped format on the log. Results from this tool provide location and orientation information of features such as fractures, lithologic contacts and cavities. The OTV digitizes 256 measurements around the borehole every 0.02 feet along the length of the borehole. Since the acquired image is digitized and properly oriented with respect to borehole deviation and tool rotation, it allows data processing to provide accurate strike and dip information of fractures and other structural features.

Heat-Pulse Flowmeter Log

The heat pulse flowmeter measures the vertical flow rates within a borehole. The log may be used to identify contributing fracture zones under natural and pumping conditions. The system operates by heating a wire grid that is located between two thermistors. The heated body of water moves toward one of the thermistors under the effect of the vertical component of flow within the well. Positive and negative values on the log represent upward and downward flow, respectively. The flow is calibrated to gallons/minute (GPM) for the flowmeter tool. The heat pulse flowmeter tool used in this investigation can detect vertical flow rates between 0.03 and 1.0 GPM.

In a formation that has strong interconnectivity between bedding planes or fractures there would be little or no expected head difference or flow between the fractures. However, in a confined rock aquifer there could be upward or downward flow in the well between the

different confined fractures. Under pumping conditions HPFM logs can provide information about the relative interconnectivity between bedding planes or fracture zones.

All instrument responses were compared and correlated for the final report interpretation. Because numerous physical measurements were collected in the wells, the interpretation confidence levels increased substantially, and potential ambiguities that may be present using data from a few measurements only, were minimized by the presence of the remaining data sets.

Logging Procedures

The logging procedures conducted at the site followed typical downhole protocol. Initially, the instrument was attached to a cable head at the end of a 4-conductor wireline. The "zero" depth was established at the appropriate benchmark (top of casing), and the recording mode of operation was initiated. The probe was lowered at approximately 3-12 feet per minute through the total depth of the well. The recording mode was terminated when the probe touched the bottom of the well. Uplog sections were also completed to ensure that geophysical responses were accurate, repeating, and within a close depth tolerance to the down log. Due to the mechanical nature of the caliper instrument, it is only possible to collect uplog data. In the office, the gamma ray data were subjected to a 5-point running average conversion factor to remove unwanted, high frequency noise components from the data set. All logs were plotted together for interpretation and presentation purposes.

Well Construction Information

The upper sections of the wells were constructed of 6" I.D. steel casing. The casing extended to varying depths below top of casing (TOC), which is the typical reference point used by AGS when logging wells. TOC at each well was 2-4 feet above ground surface. Water levels in the wells ranged from approximately 13 feet to 67 feet below TOC.

Results

The geophysical well logs collected in wells CW-15, MW-2, MW-12, and MW-29 are presented in Appendix A of this report. As stated, the depths of all logs are referenced to the top of casing. The data from the wells have been placed in four tracks on the figures, where track 1 contains the caliper and natural gamma ray data, track 2 presents the 16-inch normal resistivity, 64-inch normal resistivity, 40-inch lateral resistivity, and single-point resistance data, track 3 shows the temperature, differential temperature, fluid resistivity, and flow data, and track 4 presents the optical televiewer image data.

We have included a Fracture Category Ranking System description in Appendix B. The Fracture Category Ranking System is used to group acoustic televiewer structures into four categories (1 to 4) that are based on fracture continuity and fracture aperature, or opening size. The larger the category number the more significant the fracture.

The OTV amplitude log is presented in unwrapped format. It represents a 360 degree view of the borehole cylinder that has been opened vertically, and placed flat on the page. Given this format, any dipping surface such as a fracture plane or bedding interface will be represented by a sine wave. As the dip of the interface increases so does the amplitude of the sine wave. The dip angle is obtained by incorporating the borehole size information from caliper logs. The azimuth is obtained from gyroscope information that is continuously collected during the OTV logging operation. Typically, AGS will process the OTV data by fitting a sine curve to an interpreted televiewer fracture to estimate the dip and azimuth of the interface.

Well CW-15

The following table provides a list of important borehole features that were detected in well CW-15. The information listed in the tables reflects the log data presented in Appendix A.

Table 1: Well CW-15 Bedrock Structures

Well CW-15						
Depth (feet)	Azimuth (degrees)	Dip (degrees)	Structural Category (fracture rank)			
			1	2	3	4
73	234	40	X			
76	212	46	X			
78	228	45	X			
85	203	36	X			
86	214	40	X			
95	237	37	X			
96	227	40	X			
97	235	42	X			
110	245	43	X			
114	242	41	X			

Depth	Azimuth	Dip	1	2	3	4
116	205	40	X			
119	236	39	X			
130	263	45	X			
132	262	44	X			
133	252	31	X			
134	226	31	X			
135	226	36	X			
136	240	40	X			
138	242	41	X			
142	268	34	X			
147	250	40	X			
159	241	45	X			
188	132	82	X			
188	223	40	X			
230	240	59	X			
231	93	76	X			
231	234	49	X			
234	258	31	X			
248	243	39	X			
249	58	71	X			
250	236	46	X			
257	242	46	X			
260	239	44	X			
261	250	53	X			
263	260	45	X			

The data from CW-15 indicated several important borehole features or characteristics. AGS did not observe the presence of any significant fractures or fracture zones in the well. The caliper log did not exhibit any moderate or large increases in borehole size, the OTV images did not suggest the presence of any small-to-large aperature (all Category 1 features), through-hole fractures, the HPFM data indicated either very low-flow conditions or no flow conditions, the fluid resistivity and temperature logs did not show any abrupt changes in slope due to fluids entering the borehole, and there were no low resistivity zones that appeared to be due to a water-bearing zone. All data indicates the presence of very competent, very low flow borehole conditions.

The OTV logs indicated the presence of numerous, significant bedding plane features in the well. In CW-15, the predominant bedding plane direction was toward the southwest, between 223 and 262 degrees, and the predominant dip was between 31 and 53 degrees. These features were placed on the logs and annotated with azimuth and dip values. Several "outliers" were present, however, they were probably due to calcite-filled micro-fracturing within the limestone.

AGS noticed the presence of vertical fractures with offset at depth of 200 feet and 236-243 feet. There is noticeable vertical displacement of the limestone at these locations, but again, there is no indication that a significant water-bearing zone is present.

Finally, AGS noted the presence of numerous calcite-filled micro-fractures, cuts, openings, breaks, and other borehole irregularities throughout the well. Rocks within a depth range of 213-229 indicate a massive limestone that has been deformed and is riddled with calcite-filled micro-fractures. Rocks in the remaining parts of the well indicate bedded limestone.

Well MW-2

The following table provides a list of important borehole features that were detected in well MW-2. The information listed in the tables reflects the log data presented in Appendix A.

Table 2: Well MW-2 Bedrock Structures

Well MW-2						
Depth (feet)	Azimuth (degrees)	Dip (degrees)	Structural Category (fracture rank)			
			1	2	3	4
53	291	33	X			
54	297	29	X			
59	299	31	X			
64	318	26	X			
70	289	24	X			
72	275	20	X			
73	295	22	X			
75	287	20	X			

Depth	Azimuth	Dip	1	2	3	4
77	300	24	X			
86	291	27	X			
89	300	26	X			
89	291	29	X			
94	291	27	X			
94	121	65	X			
94	297	36	X			
103	344	24	X			
103	327	16	X			

The data in well MW-2 indicates that no significant water-bearing fractures or fracture zones were present. Similar to CW-15, the caliper log did not indicate any significant borehole openings, the OTV images did not show the presence of any significant water-bearing fractures, and the HPFM data indicated near "zero flow" fluid conditions. In addition, the resistivity values were very high, suggesting the absence of fluids in the formations, and the fluid resistivity and temperature curves possessed a relatively constant slope. All annotated features are Category 1, which is the least significant fracture/bedding plane designation. Again, the data in MW-2 indicates the presence of very competent, indurated materials with no significant fractures or fracture zones.

AGS noted numerous infilled vertical microfractures, color variations, and discrete breaks and cuts due to the drilling process. A notable vertical fracture is located at 76-80 in the well, but again, it appears to be infilled and non-water bearing. The primary dip direction of the bedding plane materials is to the west/northwest, between 275-344 degrees, and the dip angles range from 20-36 degrees.

Well MW-12

The following table provides a list of important borehole features that were detected in well MW-12. The information listed in the tables reflects the log data presented in Appendix A.

Table 3: Well MW-12 Bedrock Structures

Well MW-12						
Depth (feet)	Azimuth (degrees)	Dip (degrees)	Structural Category (fracture rank)			
			1	2	3	4
57	234	47	X			
60	232	43	X			
61	231	46	X			
64	223	41	X			
65	184	43	X			
68	187	46	X			
71	197	34	X			
71	192	40	X			
74	241	36	X			
74	228	41	X			
81	182	51	X			
81	189	57	X			
87	227	26	X			
88	209	33	X			
89	233	22	X			
91	222	27	X			
95	219	26	X			
97	215	29	X			
97	224	29	X			
99	220	29	X			

The data in well MW-12 indicates that no significant water-bearing fractures or fracture zones were present. Similar to the other wells, the caliper log did not indicate any significant borehole openings, the OTV images did not show the presence of any significant water-bearing fractures, and the HPFM data indicated near "zero flow" fluid conditions. In addition, the resistivity values were high, and the fluid resistivity and temperature curves possessed a relatively constant slope. All annotated features are Category 1, which is the least significant fracture/bedding plane designation. Again, the data in MW-12 indicates very competent,

indurated materials with no significant fractures or fracture zones.

AGS noted the presence of bedding planes throughout the well. The primary dip direction of the bedding plane materials is to the south/southwest, between 182-234 degrees, and the dip angles range from 22-51 degrees, as shown in Table 3.

Well MW-29

The following table provides a list of important borehole features that were detected in well MW-29. The information listed in the tables reflects the log data presented in Appendix A.

Table 4: Well MW-29 Bedrock Structures

Well MW-29						
Depth (feet)	Azimuth (degrees)	Dip (degrees)	Structural Category (fracture rank)			
			1	2	3	4
26	322	26	X			
27	316	26	X			
28	308	34	X			
34	125	77	X			
43	310	26	X			
54	258	37	X			

The data in well MW-29 again indicates that no significant water-bearing fractures or fracture zones were present. Similar to the other wells, the caliper log did not indicate any significant borehole openings, the OTV images did not show the presence of any significant water-bearing fractures, and the HPFM data indicated near "zero flow" fluid conditions. Again, the resistivity values were high, and there were no significant changes in the fluid resistivity and temperature curves. All annotated features are Category 1, which is the least significant fracture/bedding plane designation. Again, the data in MW-29 indicates a very competent, indurated materials with no significant fractures or fracture zones.

AGS noted only a few bedding plane features in the well. The primary dip direction of the

bedding plane materials is to the west/northwest, between 258-322 degrees, and the dip angles range from 26-37 degrees. AGS noted a distinct color change in the rocks at 27 feet. It is apparent that a lithologic change is occurring at this depth.

Data Quality

The quality of the geophysical logs was very good, the responses were consistent, and the log responses repeated well during test runs for quality control. Unfortunately, usable data could not be collected with the optical televiewer due to the large amount of suspended sediment in the borehole at the time of logging.

The data collection and interpretation methodologies used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site.

If you have any questions, please contact me at 610-722-5500. It was a pleasure working with you on this project, and I look forward to conducting geophysical investigations for you in the future.

Sincerely,

Peter T. Miller, Ph.D., P.G.
Senior Geophysicist

Encl.: Appendix A - Geophysical Well Logs
Appendix B – Fracture Category Ranking

Appendix A
Geophysical Well Logs

ADVANCED GEOLOGICAL SERVICES

3 Mystic Lane
Malvern. PA 19355
610-722-5500
610-722-0250 fax

Multi-Tool/Optical Televiewer/Caliper/Flowlog

CO
WELL MW-2
SITE:ADP Site
CTY York
STE PA
FILING No

CLIENT Groundwater Sciences, Inc.
WELL ID MW-2
SITE
CITY York **STATE** PA

LOCATION
SEC TWP RGE

OTHER SERVICES

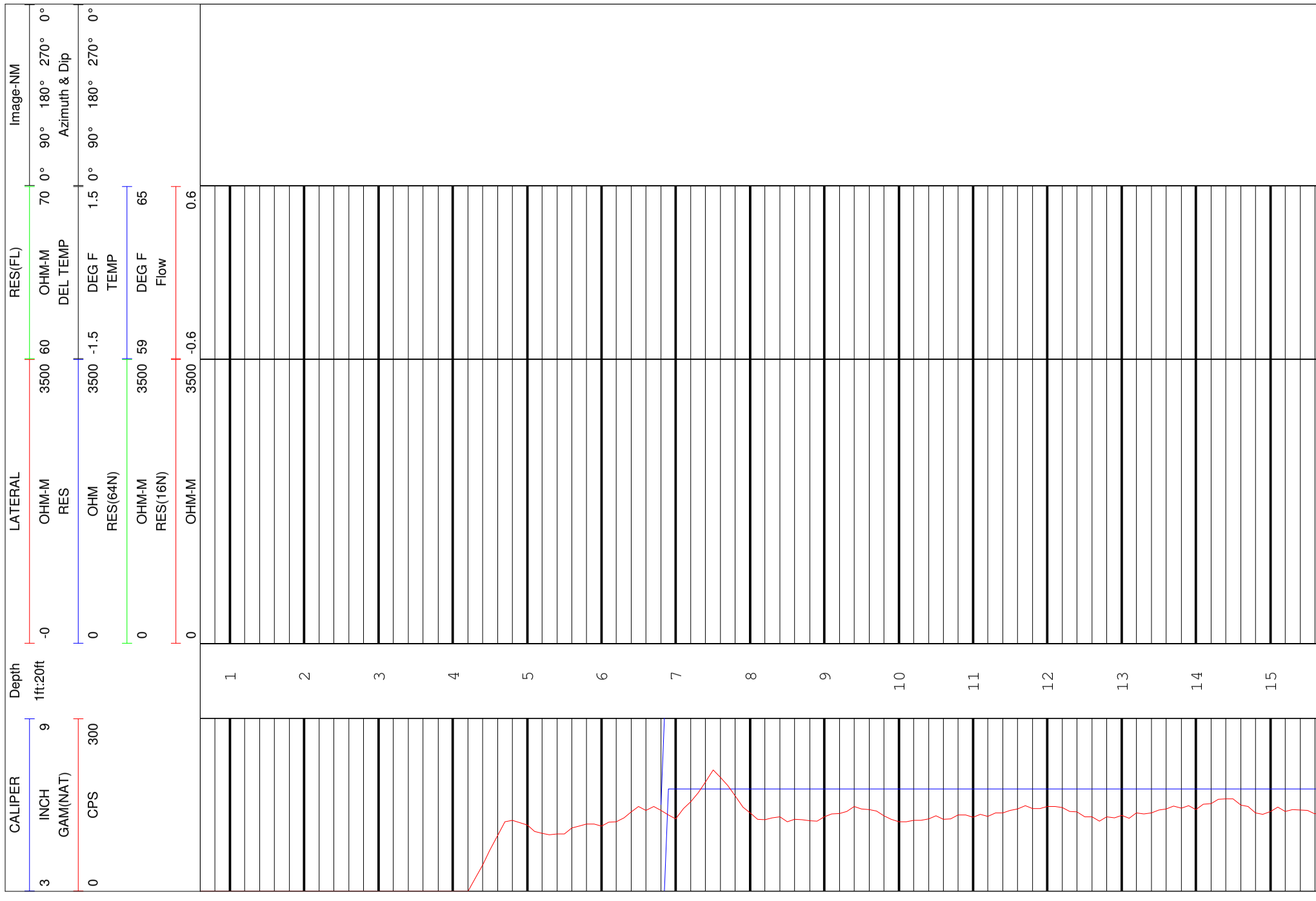
PERMANENT DATUM: ELEVATION K.B.

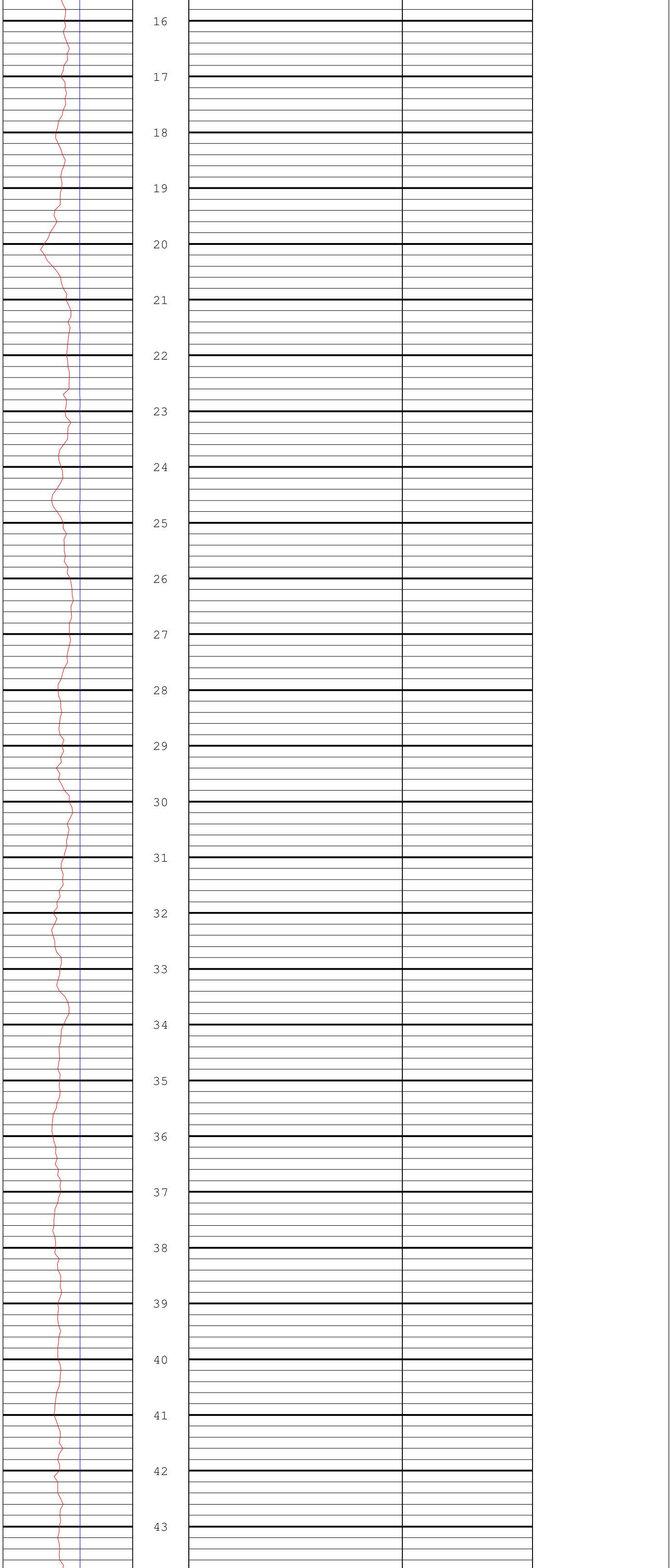
LOG MEAS. FROM: Ground Surface ABOVE PERM. DATUM D.F.

DRILLING MEAS. FROM: G.L.

DATE	September 7, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	123 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:

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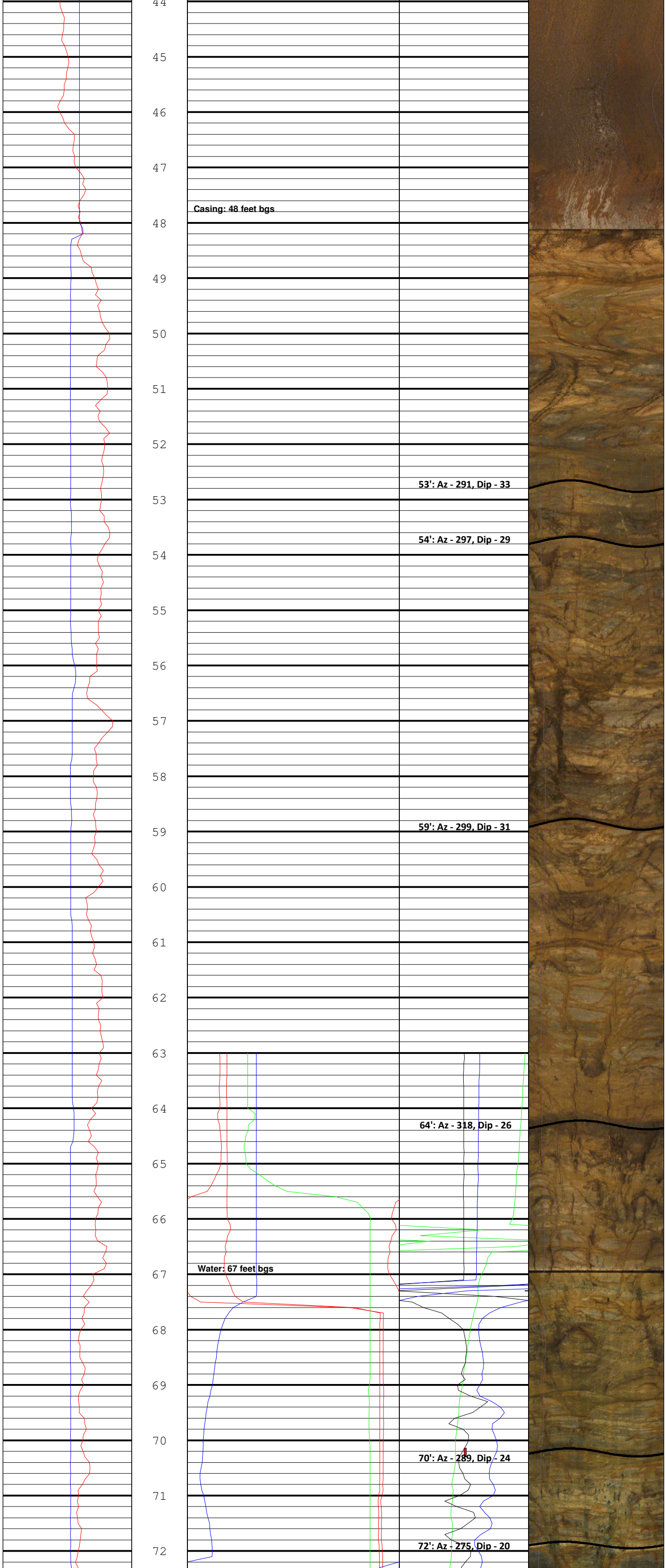
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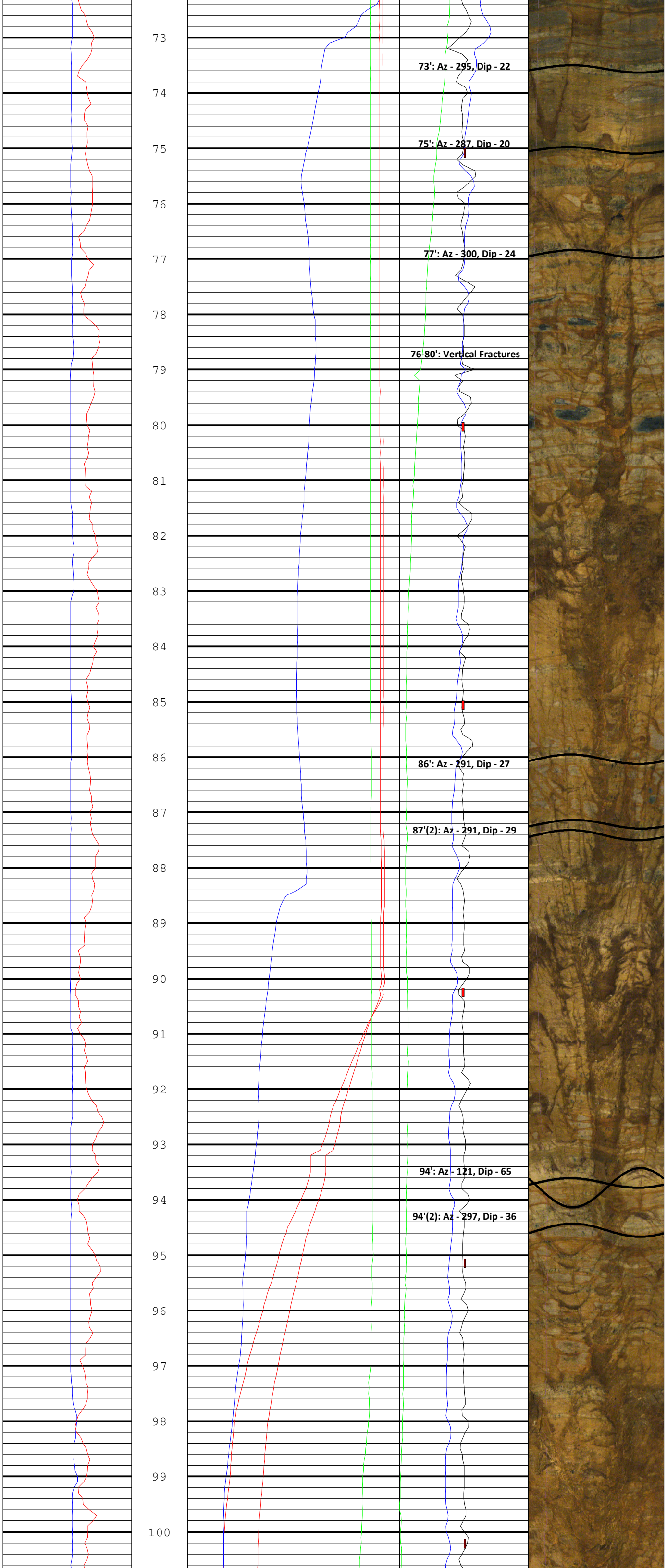
Casing: 48 feet bgs
53': Az - 291, Dip - 33
54': Az - 297, Dip - 29
59': Az - 299, Dip - 31
64': Az - 318, Dip - 26
Water: 67 feet bgs
70': Az - 289, Dip - 24
72': Az - 275, Dip - 20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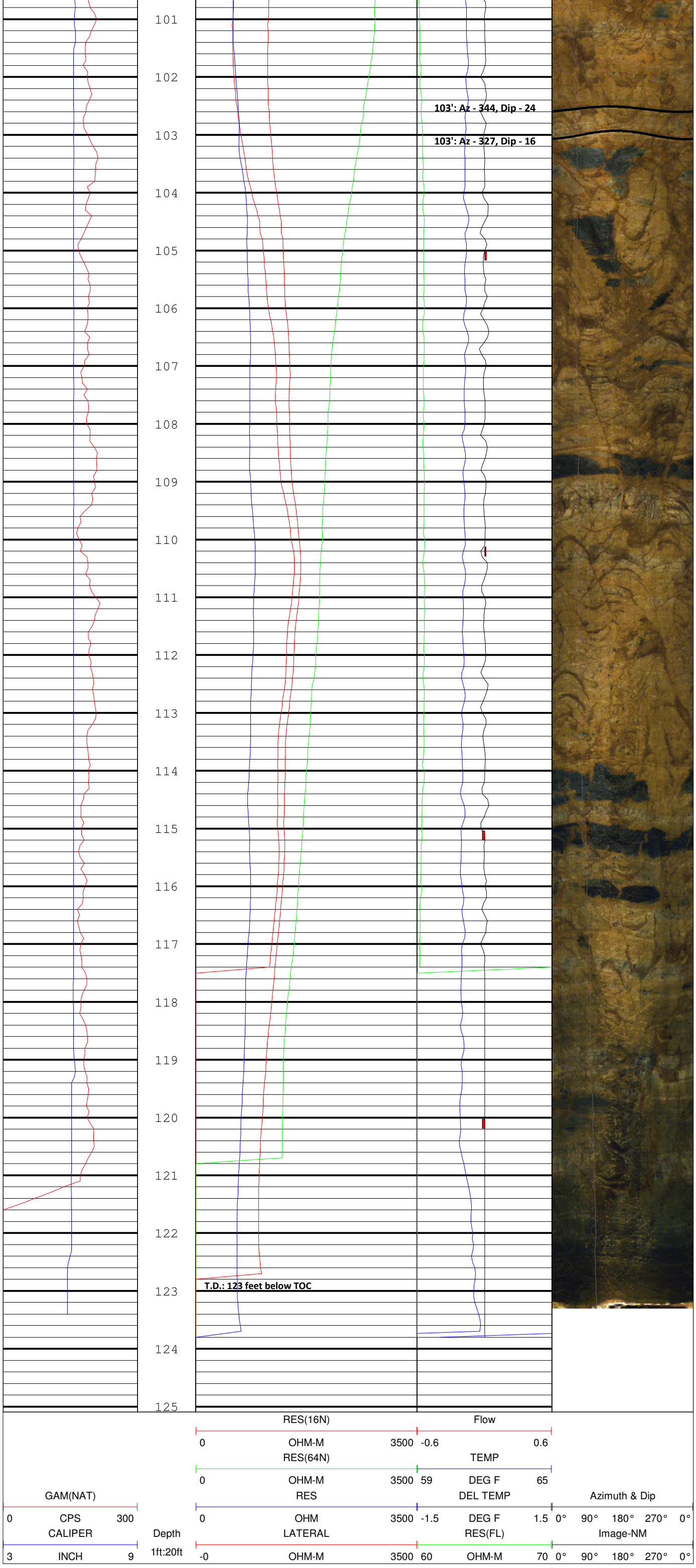
73': Az - 295, Dip - 22
75': Az - 287, Dip - 20
77': Az - 300, Dip - 24
76-80': Vertical Fractures
86': Az - 291, Dip - 27
87'(2): Az - 291, Dip - 29
94': Az - 121, Dip - 65
94'(2): Az - 297, Dip - 36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103': Az - 344, Dip - 24
103': Az - 327, Dip - 16
T.D.: 123 feet below TOC
RES(16N)
0 OHM-M 3500
Flow
-0.6 0.6
RES(64N)
0 OHM-M 3500
TEMP
59 DEG F 65
GAM(NAT)
0 CPS 300
RES
0 OHM 3500
DEL TEMP
-1.5 DEG F 1.5
Azimuth & Dip
0° 90° 180° 270° 0°
CALIPER
3 INCH 9
Depth
1ft:20ft
LATERAL
-0 OHM-M 3500
RES(FL)
60 OHM-M 70
Image-NM
0° 90° 180° 270° 0°

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Malvern, PA 19355
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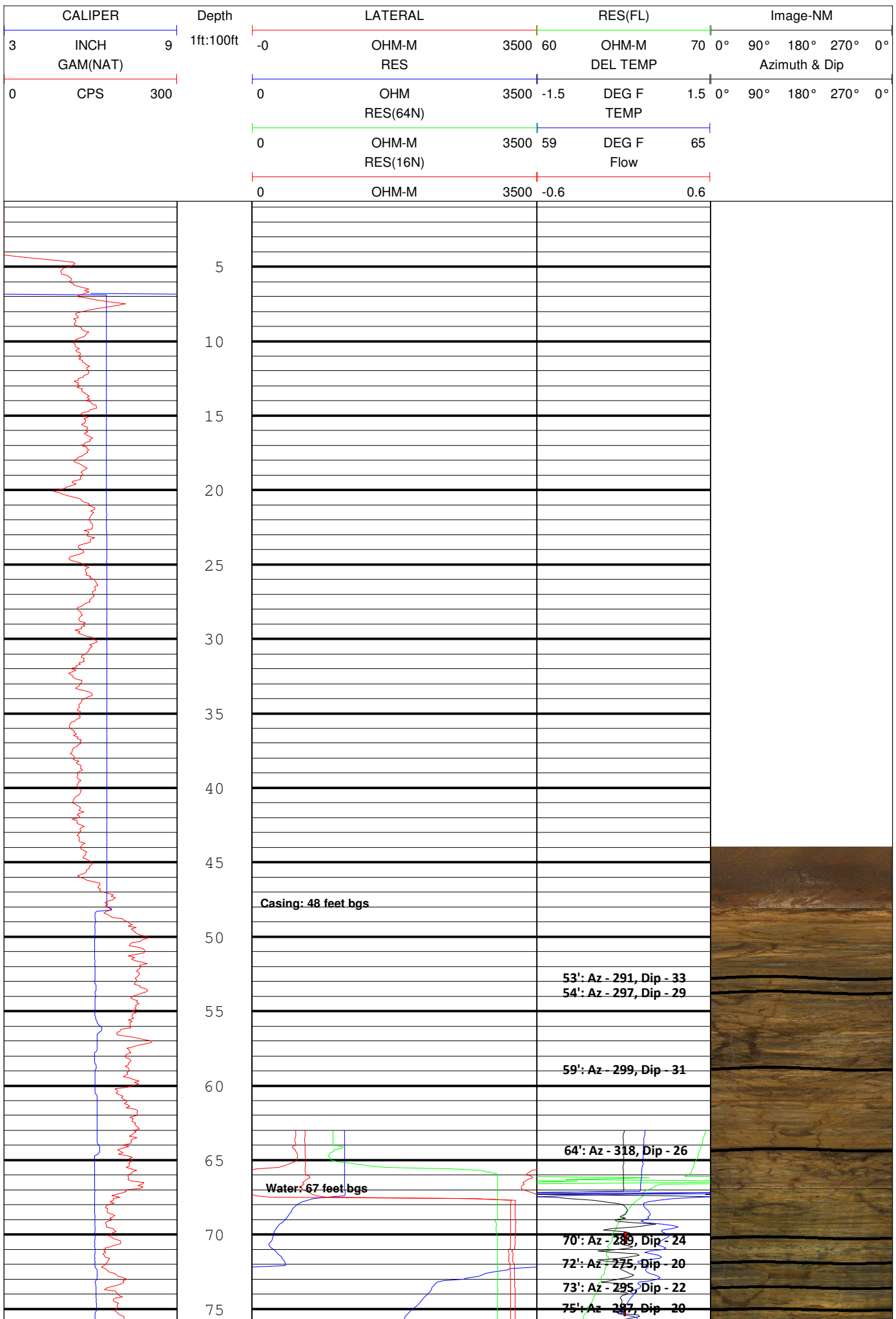
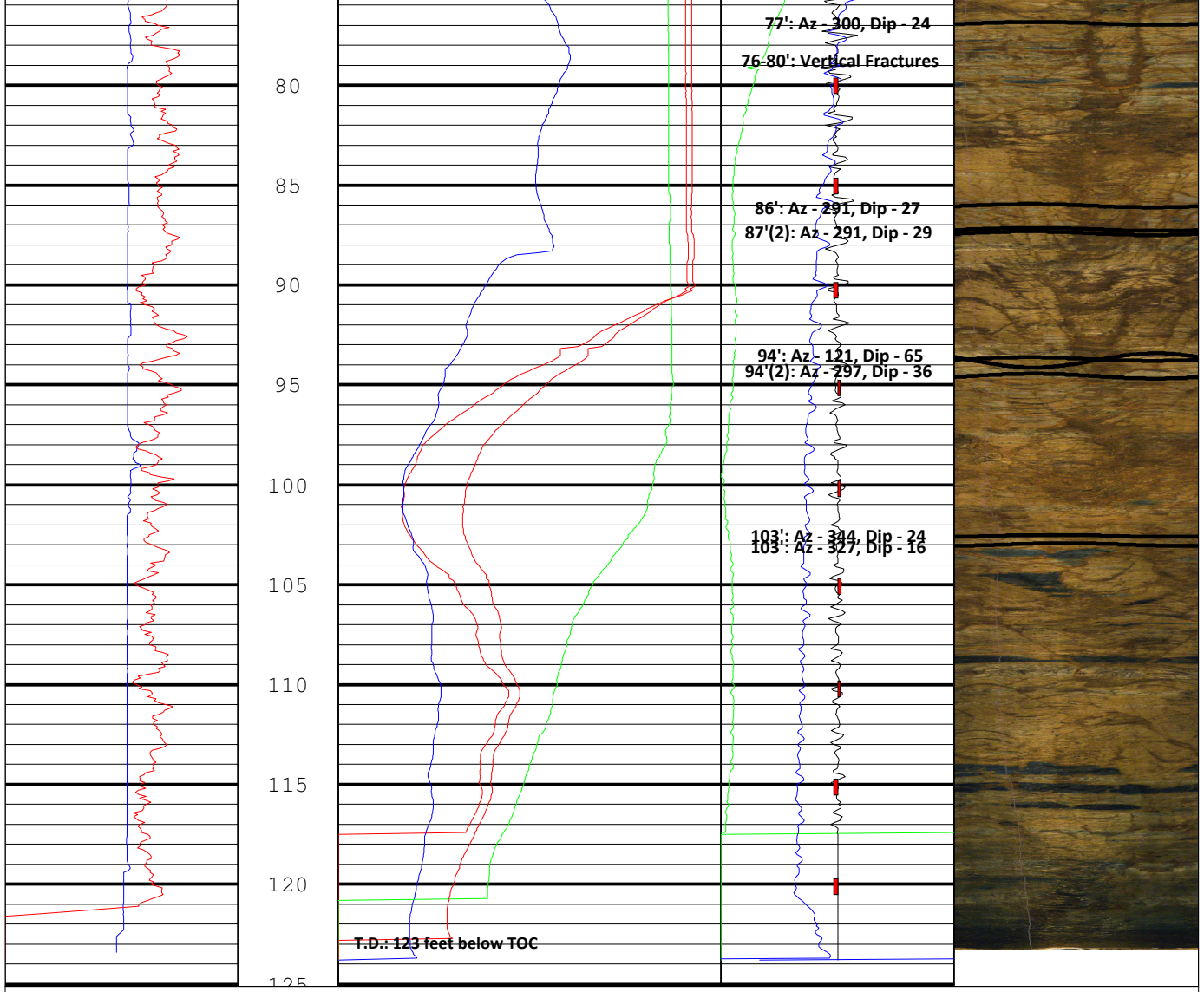
Multi-Tool/Optical Televiewer/Caliper/Flowlog

CLIENT Groundwater Sciences, Inc.			
WELL ID MW-2			
SITE			
CITY York		**STATE** PA	
LOCATION			OTHER SERVICES
SEC	TWP	RGE	
PERMANENT DATUM:	ELEVATION		K.B.
LOG MEAS. FROM: Ground Surface	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM:			G.L.

DATE	September 7, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	123 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:





			RES(16N)			Flow			
		0	OHM-M	3500	-0.6		0.6		
			RES(64N)			TEMP			
		0	OHM-M	3500	59	DEG F	65		
GAM(NAT)			RES			DEL TEMP		Azimuth & Dip	
0	CPS	300	0	OHM	3500	-1.5	DEG F	1.5	0° 90° 180° 270° 0°
CALIPER	Depth		LATERAL			RES(FL)		Image-NM	
3	INCH	9	1ft:100ft	-0	OHM-M	3500	60	OHM-M	70 0° 90° 180° 270° 0°

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Multi-Tool/Optical Televiewer/Caliper/Flowlog

CO
WELL MW-12
SITE:ADP Site
CTY York
STE PA
FILING No

CLIENT Groundwater Sciences, Inc.
WELL ID MW-12
SITE
CITY York **STATE** PA

LOCATION
SEC TWP RGE

OTHER SERVICES

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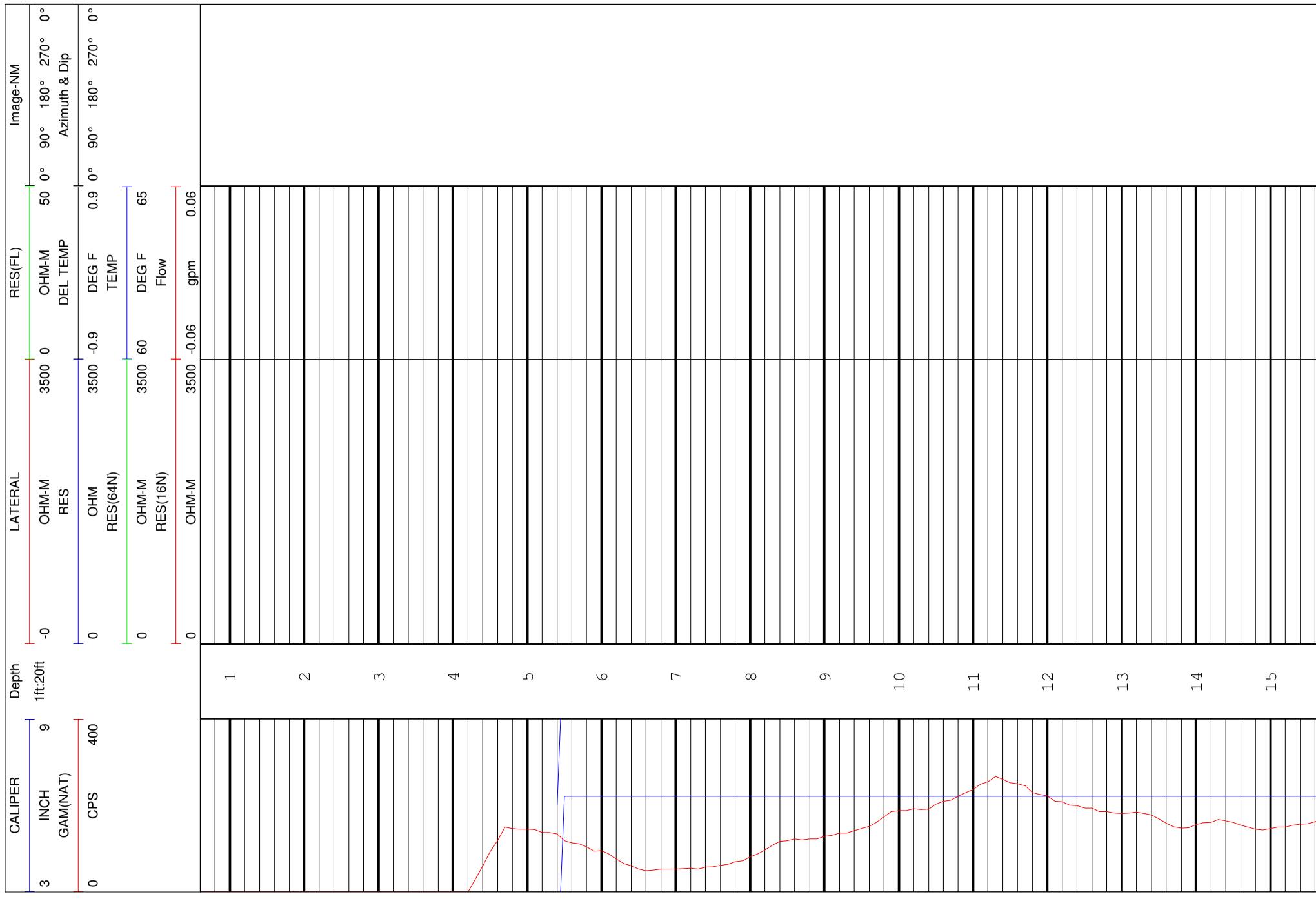
DATE	September 7, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	100 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:



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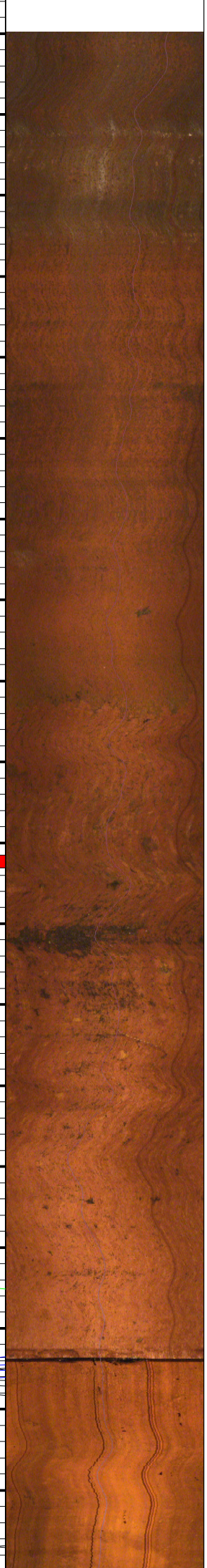
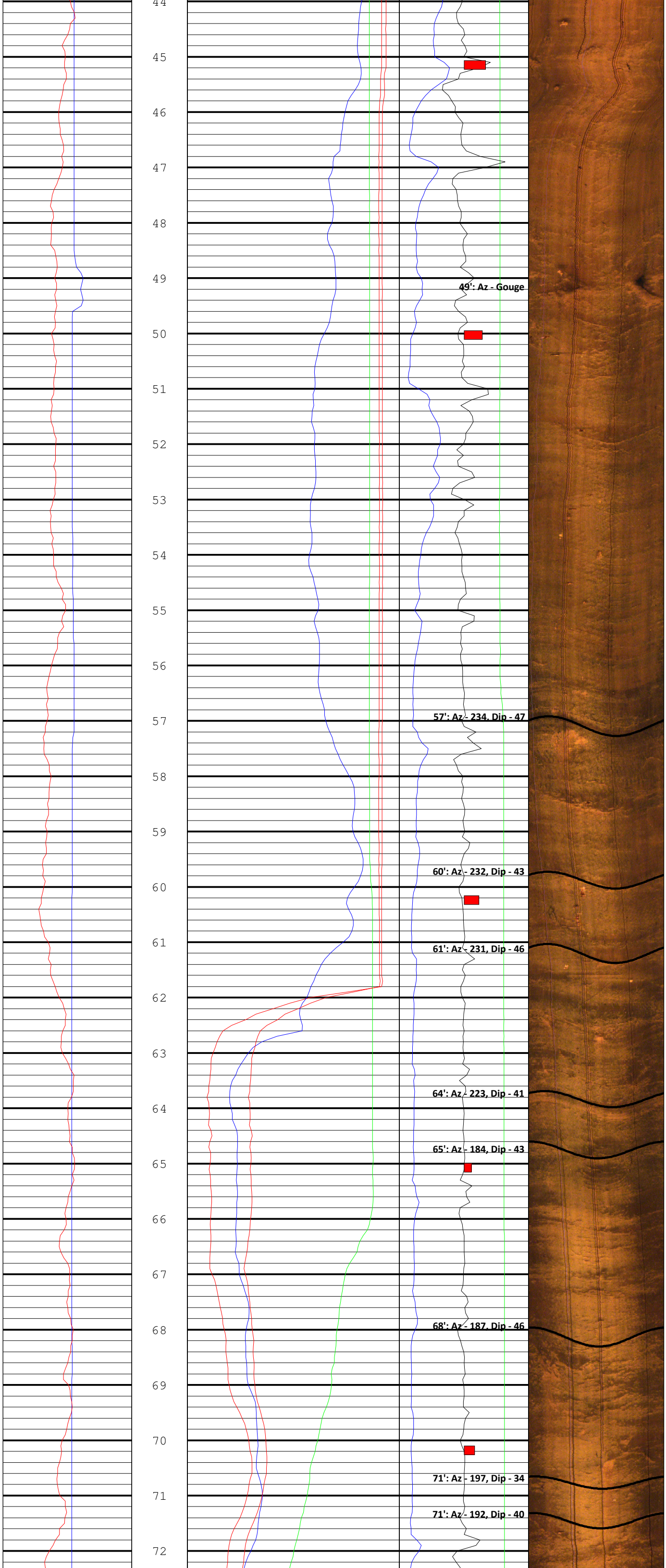
Casing: 30 feet bgs

Water Level: 41 feet bgs

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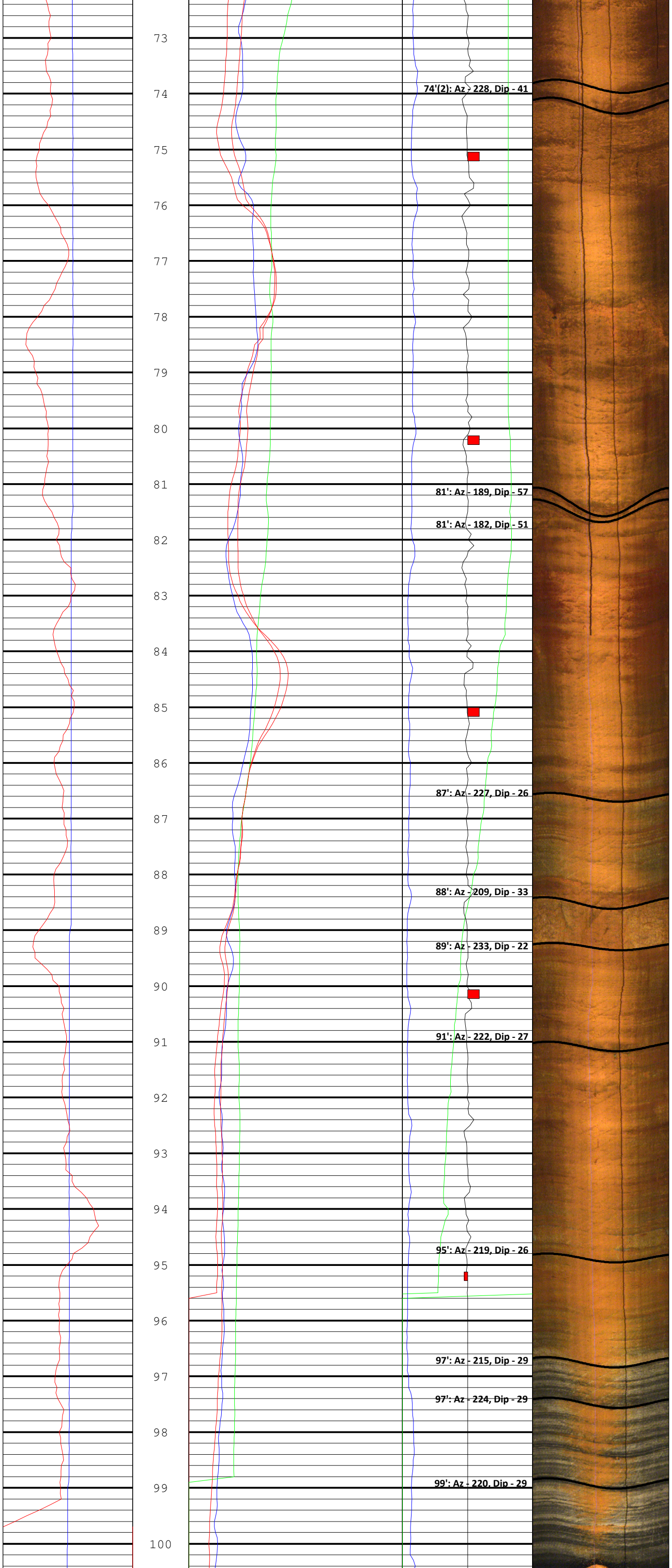
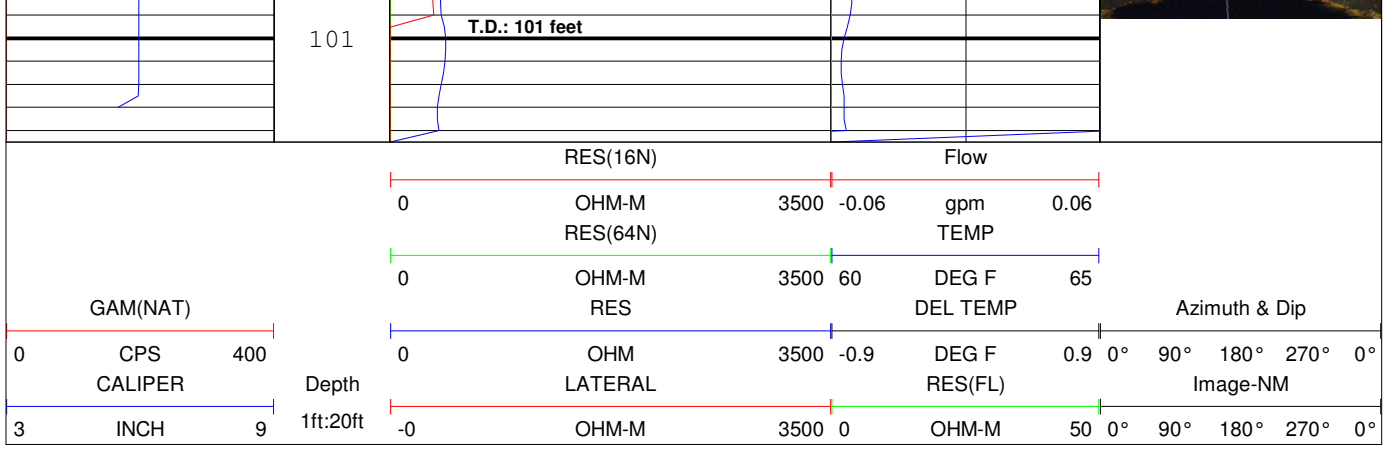
49': Az - Gouge
57': Az - 234, Dip - 47
60': Az - 232, Dip - 43
61': Az - 231, Dip - 46
64': Az - 223, Dip - 41
65': Az - 184, Dip - 43
68': Az - 187, Dip - 46
71': Az - 197, Dip - 34
71': Az - 192, Dip - 40


73
74
74'(2): Az - 228, Dip - 41
75
76
77
78
79
80
81
81': Az - 189, Dip - 57
81': Az - 182, Dip - 51
82
83
84
85
86
87': Az - 227, Dip - 26
87
88
88': Az - 209, Dip - 33
89
89': Az - 233, Dip - 22
90
91
91': Az - 222, Dip - 27
92
93
94
95
95': Az - 219, Dip - 26
96
97
97': Az - 215, Dip - 29
97': Az - 224, Dip - 29
98
99
99': Az - 220, Dip - 29
100

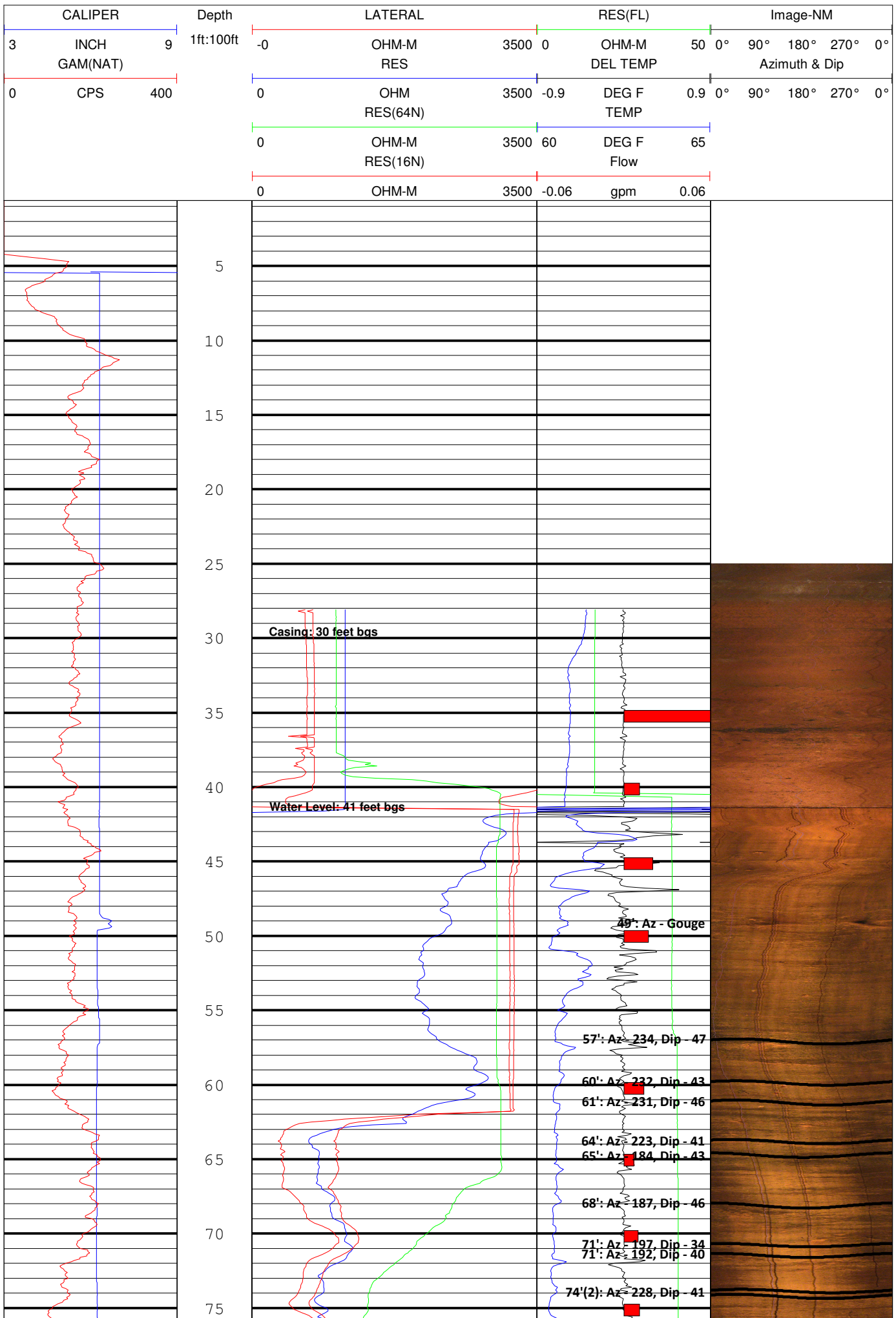

101
T.D.: 101 feet
RES(16N)
Flow
0
OHM-M
3500
-0.06
gpm
0.06
RES(64N)
TEMP
0
OHM-M
3500
60
DEG F
65
GAM(NAT)
RES
DEL TEMP
Azimuth & Dip
0
CPS
400
0
OHM
3500
-0.9
DEG F
0.9
0°
90°
180°
270°
0°
CALIPER
Depth
LATERAL
RES(FL)
Image-NM
3
INCH
9
1ft:20ft
-0
OHM-M
3500
0
OHM-M
50
0°
90°
180°
270°
0°

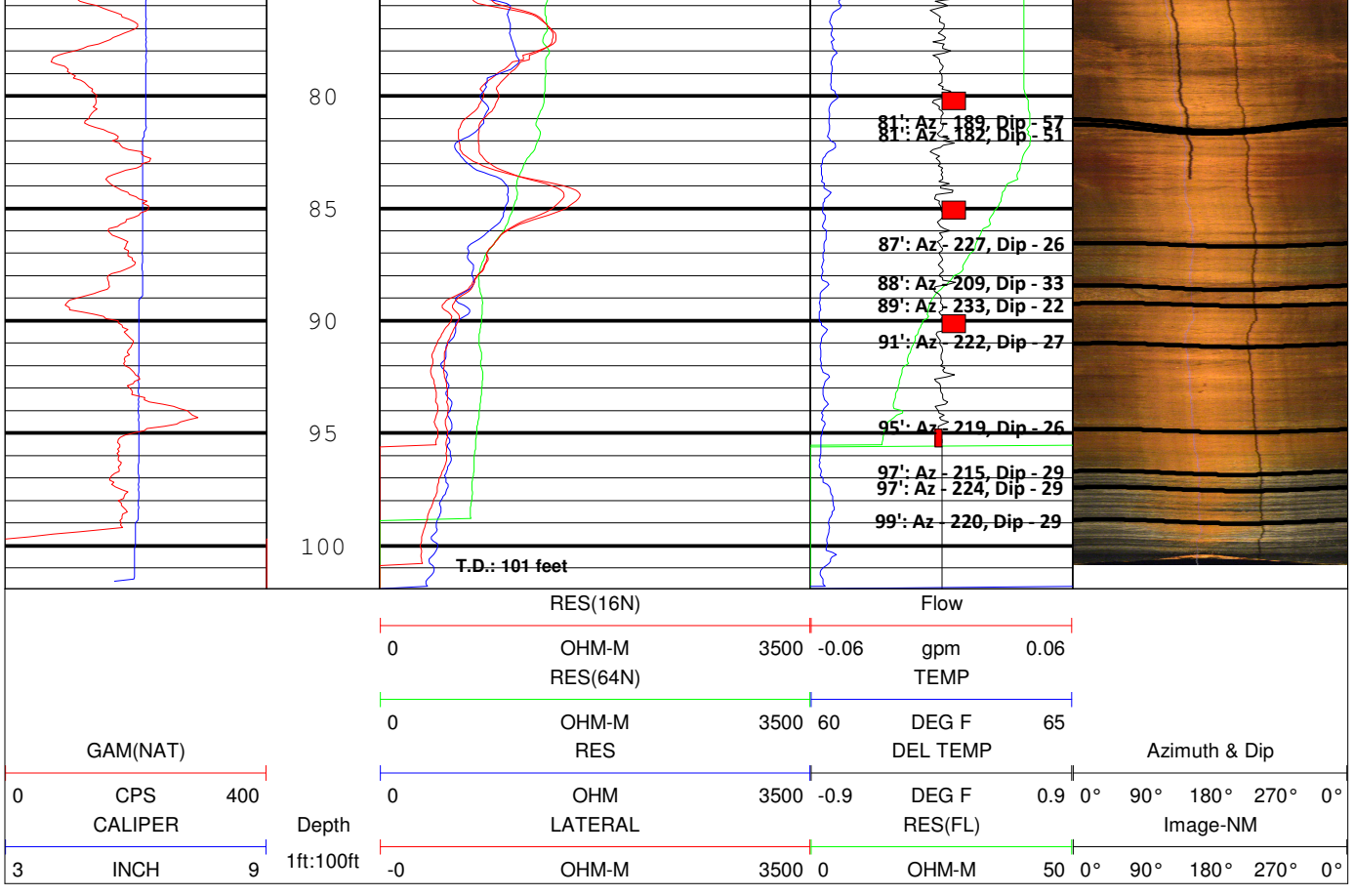
ADVANCED GEOLOGICAL SERVICES
3 Mystic Lane
Malvern, PA 19355
610-722-5500
610-722-0250 fax

Multi-Tool/Optical Televiewer/Caliper/Flowlog

CO	**CLIENT** Groundwater Sciences, Inc.		
WELL MW-12	**WELL ID** MW-12		
SITE:ADP Site	**SITE**		
CTY York	**CITY** York	**STATE** PA	
STE PA	LOCATION		OTHER SERVICES
FILING No	SEC TWP RGE		
PERMANENT DATUM: Ground Surface	ELEVATION	K.B.	
LOG MEAS. FROM: Ground Surface	ABOVE PERM. DATUM	D.F.	
DRILLING MEAS. FROM:		G.L.	
DATE	September 7, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	100 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:




80
85
90
95
100
81': Az - 189, Dip - 57
81': Az - 182, Dip - 51
87': Az - 227, Dip - 26
88': Az - 209, Dip - 33
89': Az - 233, Dip - 22
91': Az - 222, Dip - 27
95': Az - 219, Dip - 26
97': Az - 215, Dip - 29
97': Az - 224, Dip - 29
99': Az - 220, Dip - 29
T.D.: 101 feet
RES(16N)
Flow
0 OHM-M 3500 -0.06 gpm 0.06
RES(64N)
TEMP
0 OHM-M 3500 60 DEG F 65
GAM(NAT)
RES
DEL TEMP
Azimuth & Dip
0 CPS 400 0 OHM 3500 -0.9 DEG F 0.9 0° 90° 180° 270° 0°
CALIPER
Depth
LATERAL
RES(FL)
Image-NM
3 INCH 9 1ft:100ft -0 OHM-M 3500 0 OHM-M 50 0° 90° 180° 270° 0°

ADVANCED GEOLOGICAL SERVICES

3 Mystic Lane
Malvern. PA 19355
610-722-5500
610-722-0250 fax

Multi-Tool/Optical Televiewer/Caliper/Flowlog

CO
WELL CW-15
SITE:ADP Site
CTY York
STE PA
FILING No

CLIENT Groundwater Sciences, Inc.
WELL ID CW-15
SITE
CITY York **STATE** PA

LOCATION
SEC TWP RGE

OTHER SERVICES

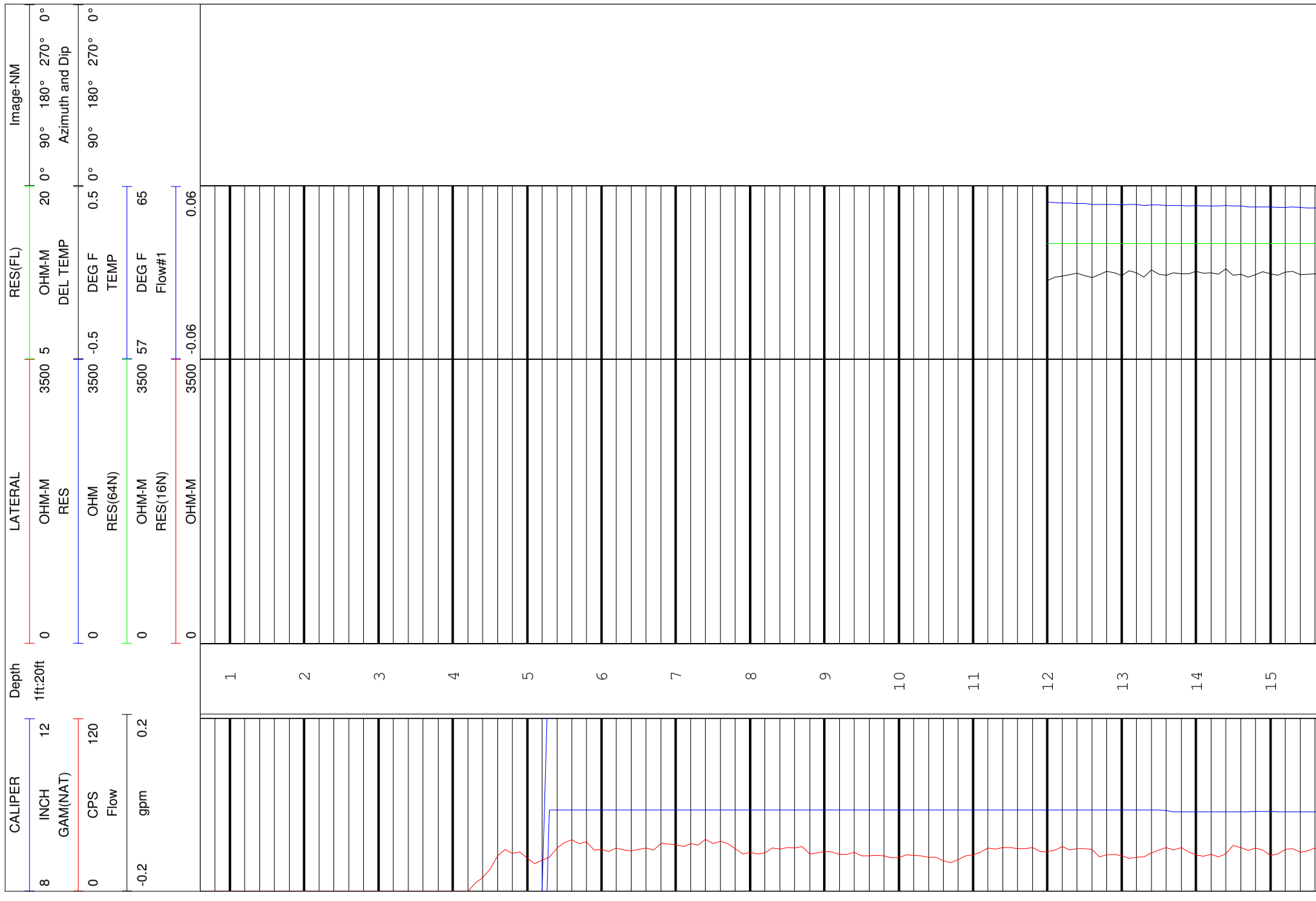
PERMANENT DATUM: ELEVATION K.B.

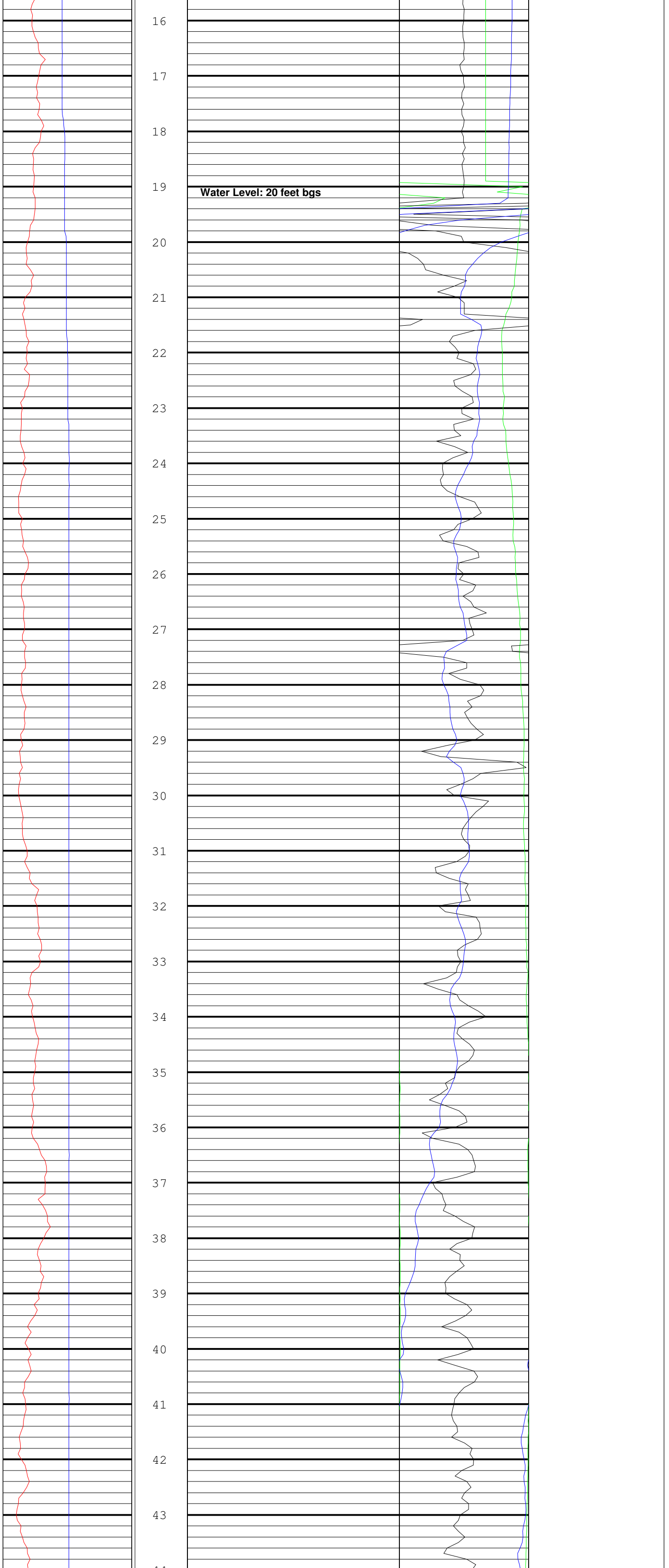
LOG MEAS. FROM: Ground Surface ABOVE PERM. DATUM D.F.

DRILLING MEAS. FROM: G.L.

DATE	August 27, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	270 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:




16
17
18
19
Water Level: 20 feet bgs
20
21
22
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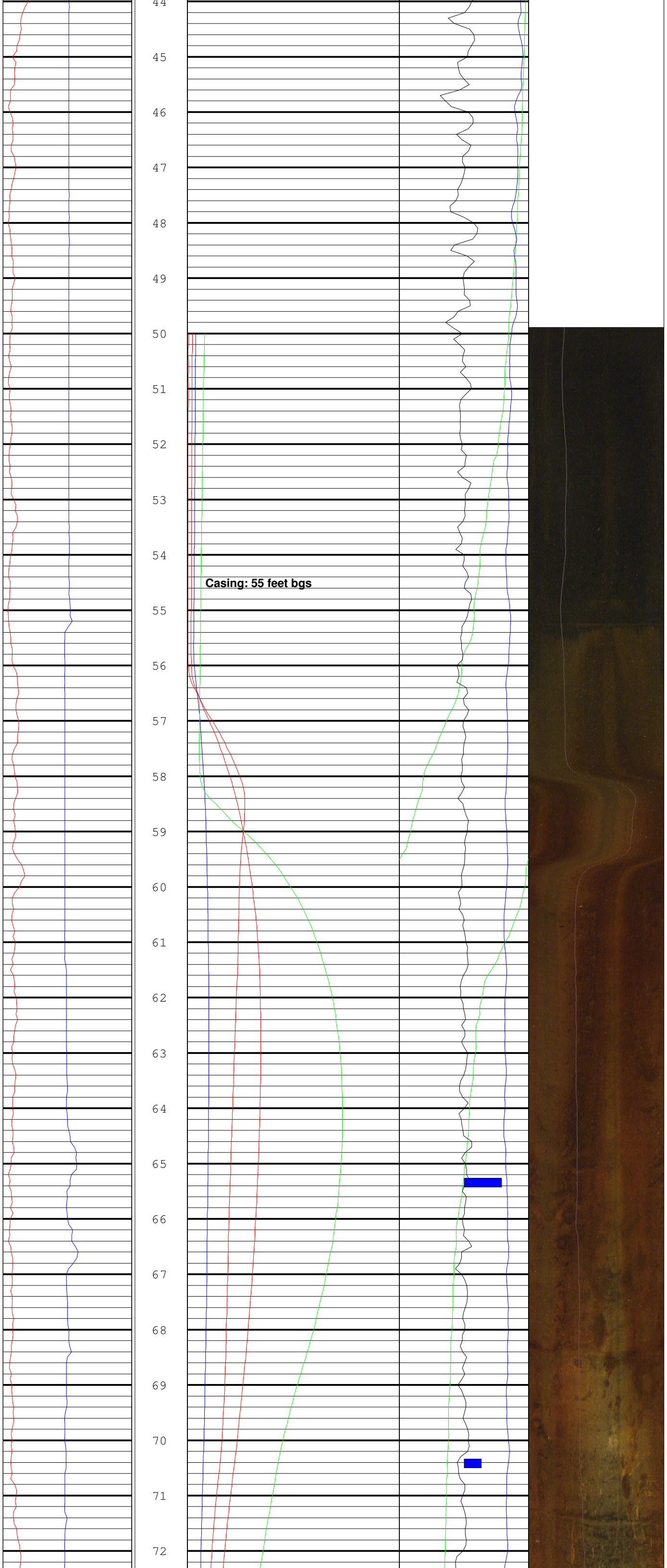
41
42
43


44
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54
55
56
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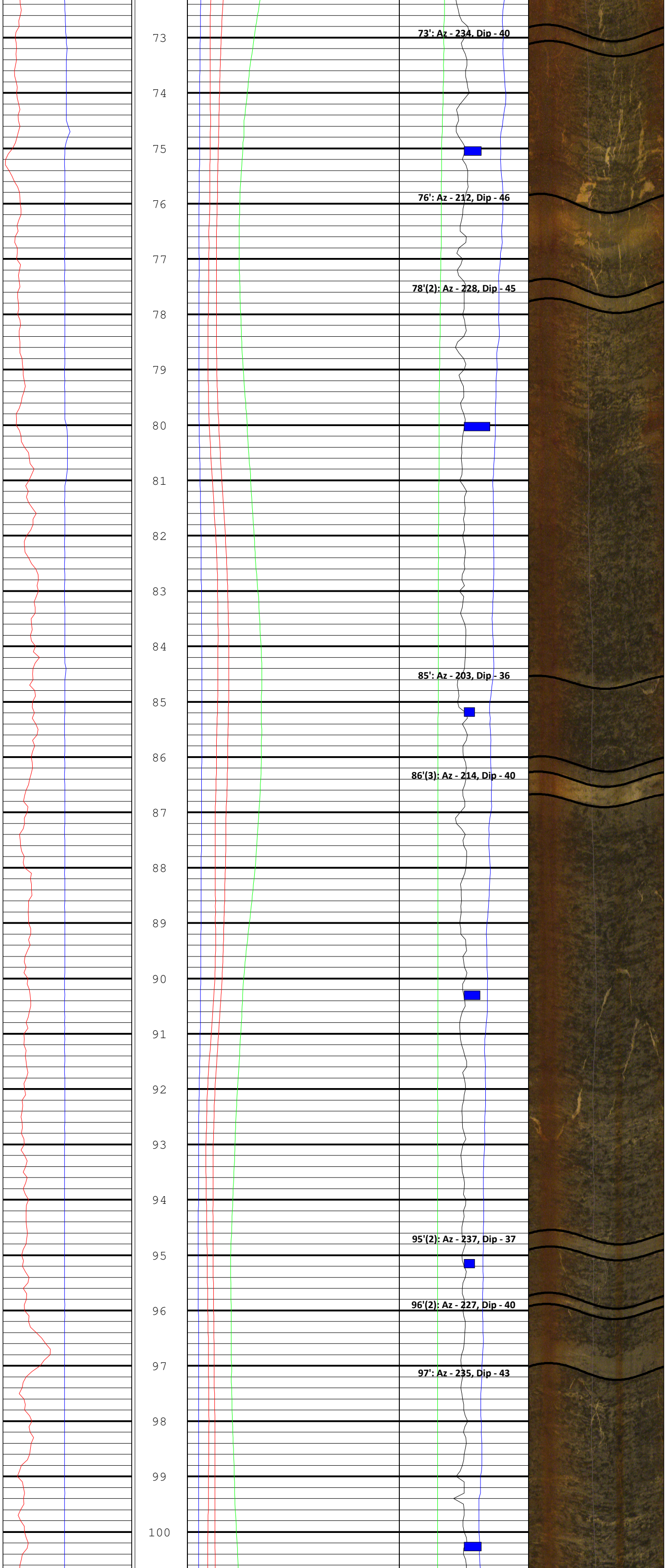
61
62
63
64
65
66
67
68
69
70
71
72
Casing: 55 feet bgs


73
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81
82
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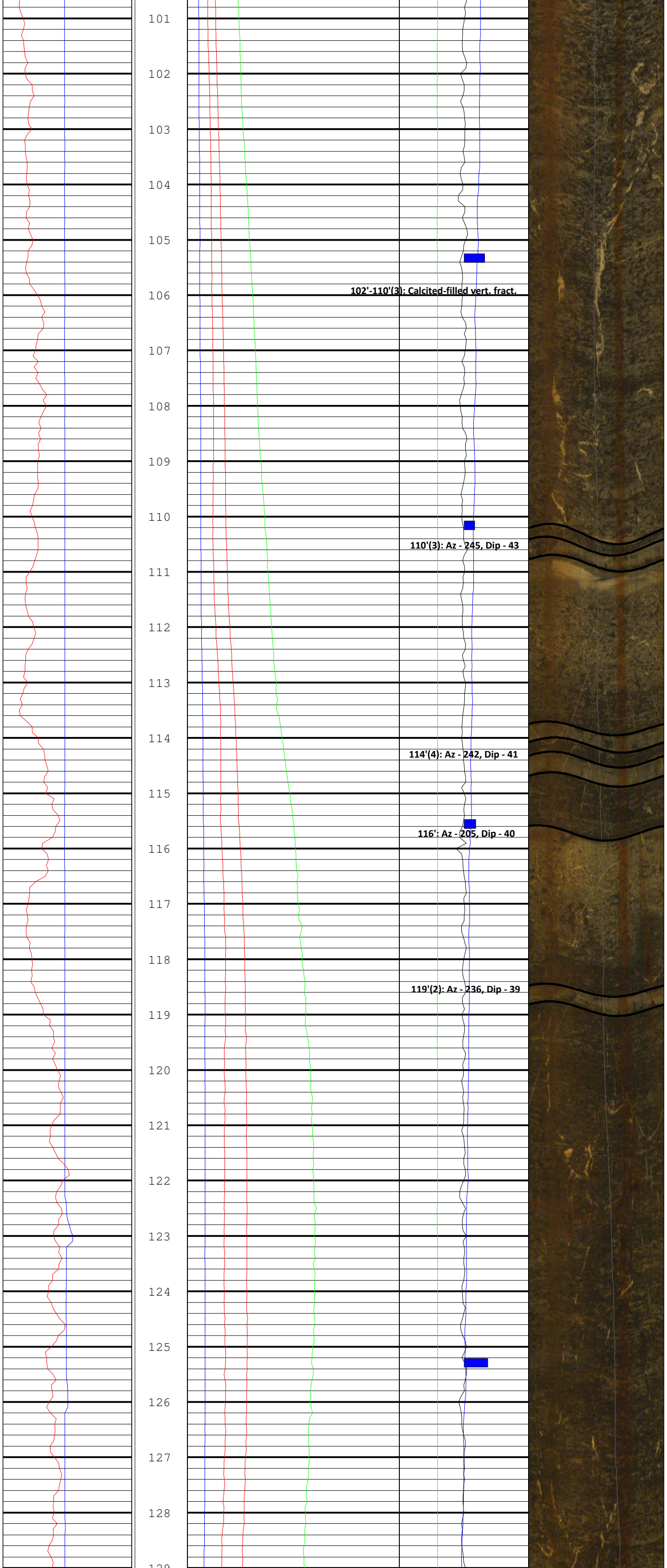
88
89
90
91
92
93
94
95
96
97
98
99
100
73': Az - 234, Dip - 40
76': Az - 212, Dip - 46
78'(2): Az - 228, Dip - 45
85': Az - 203, Dip - 36
86'(3): Az - 214, Dip - 40
95'(2): Az - 237, Dip - 37
96'(2): Az - 227, Dip - 40
97': Az - 235, Dip - 43


101
102
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104
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110
111
112
113
114
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116
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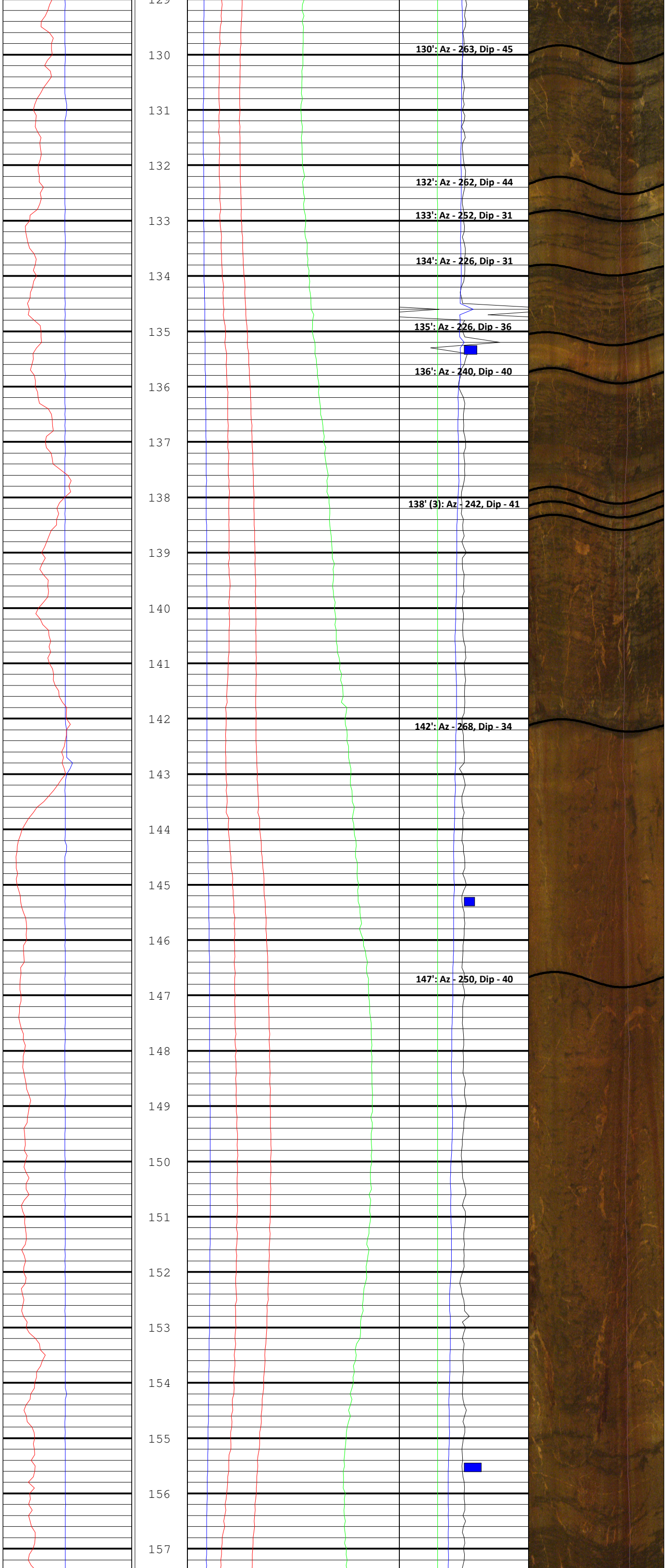
118
119
120
121
122
123
124
125
126
127
128
102'-110'(3): Calcited-filled vert. fract.
110'(3): Az - 245, Dip - 43
114'(4): Az - 242, Dip - 41
116': Az - 205, Dip - 40
119'(2): Az - 236, Dip - 39


129
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141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
130': Az - 263, Dip - 45
132': Az - 262, Dip - 44
133': Az - 252, Dip - 31
134': Az - 226, Dip - 31
135': Az - 226, Dip - 36
136': Az - 240, Dip - 40
138' (3): Az - 242, Dip - 41
142': Az - 268, Dip - 34
147': Az - 250, Dip - 40

158
159
160
161
162
163
164
165
166
167
168
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171
172
173
174
175
176
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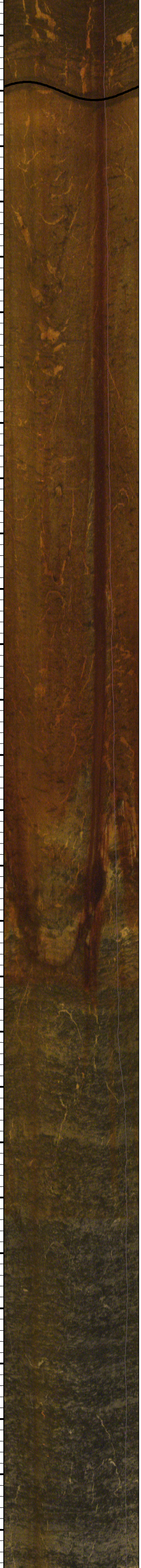
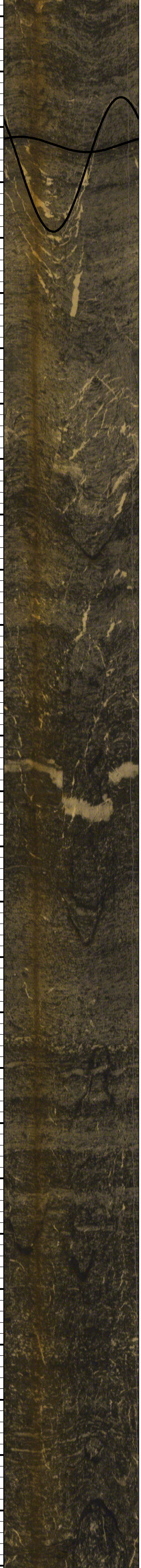
178
179
180
181
182
183
184
185

159': Az - 241, Dip - 45



186
187
188
188': Az - 223, Dip - 40
188': Az - 132, Dip - 82
189
190
191
192
193
194
195
196
197
198
199
200': Vertical Fracture
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214



215
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217
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223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242

213-229: Microfracts, Deformities

230': Az - 240, Dip - 59

231': Az - 240, Dip - 59

231': Az - 93, Dip - 76

234': Az - 258, Dip - 31

236-243: Vertical microfract.

243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270

248': Az - 243, Dip - 39

249': Az - 58, Dip - 71

250' (2): Az - 236, Dip - 46

259': Az - 242, Dip - 46

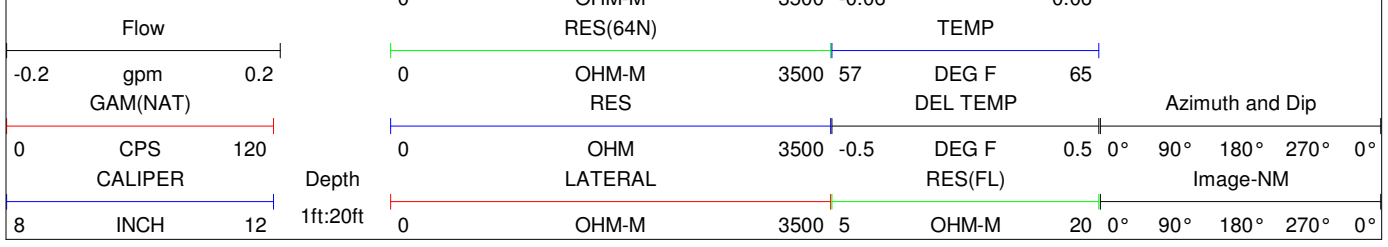
261': Az - 250, Dip - 53

263': Az - 260, Dip - 45

T.D.: 270 feet

RES(16N)
0 OHM-M 3500

Flow#1
-0.06 0.06


Flow
-0.2
gpm
0.2
GAM(NAT)
0
CPS
120
CALIPER
8
INCH
12
Depth
1ft:20ft
RES(64N)
0
OHM-M
3500
TEMP
57
DEG F
65
RES
0
OHM
3500
DEL TEMP
-0.5
DEG F
0.5
Azimuth and Dip
0°
90°
180°
270°
0°
LATERAL
0
OHM-M
3500
RES(FL)
5
OHM-M
20
Image-NM
0°
90°
180°
270°
0°

ADVANCED GEOLOGICAL SERVICES
3 Mystic Lane
Malvern, PA 19355
610-722-5500
610-722-0250 fax

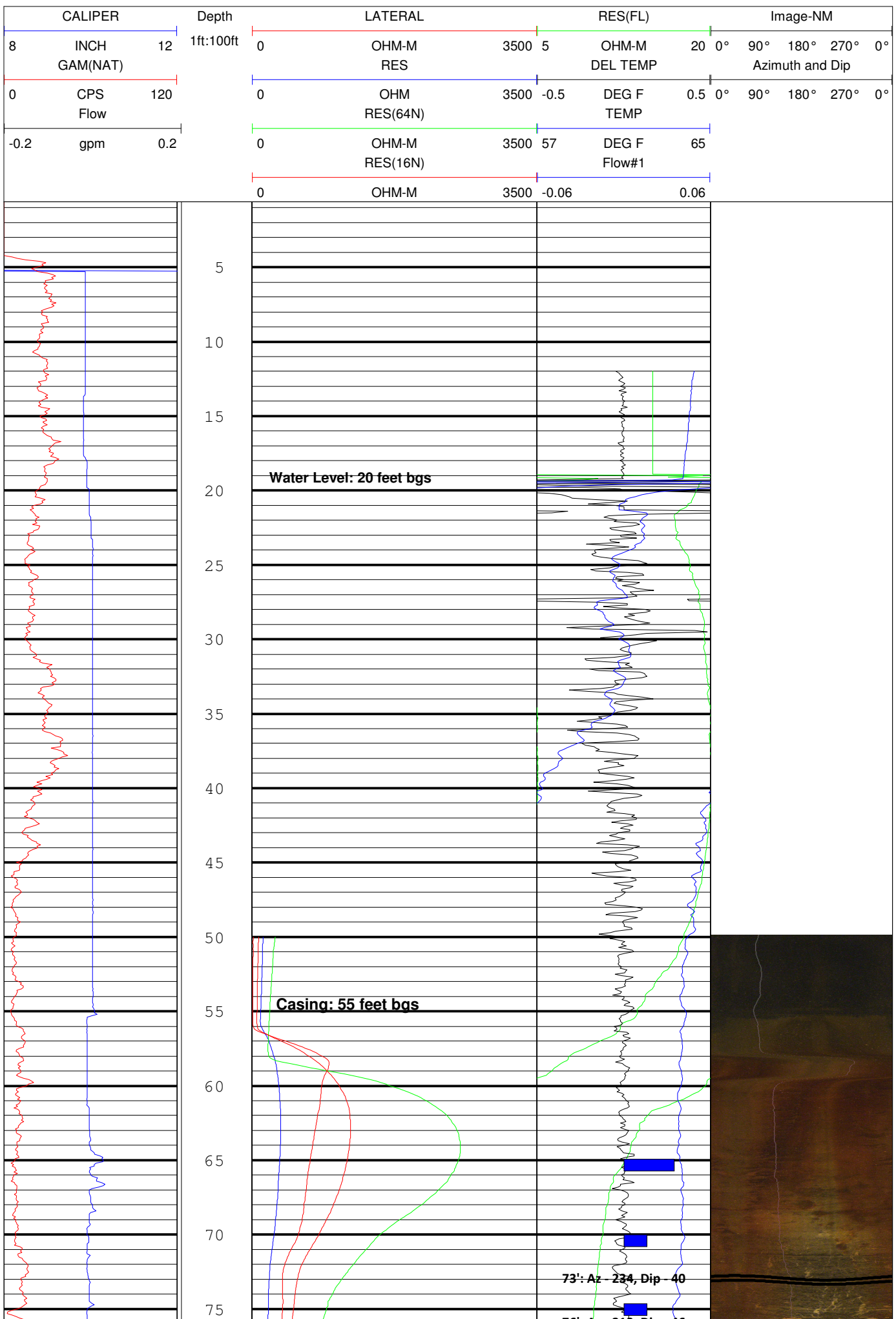
Multi-Tool/Optical Televiewer/Caliper/Flowlog

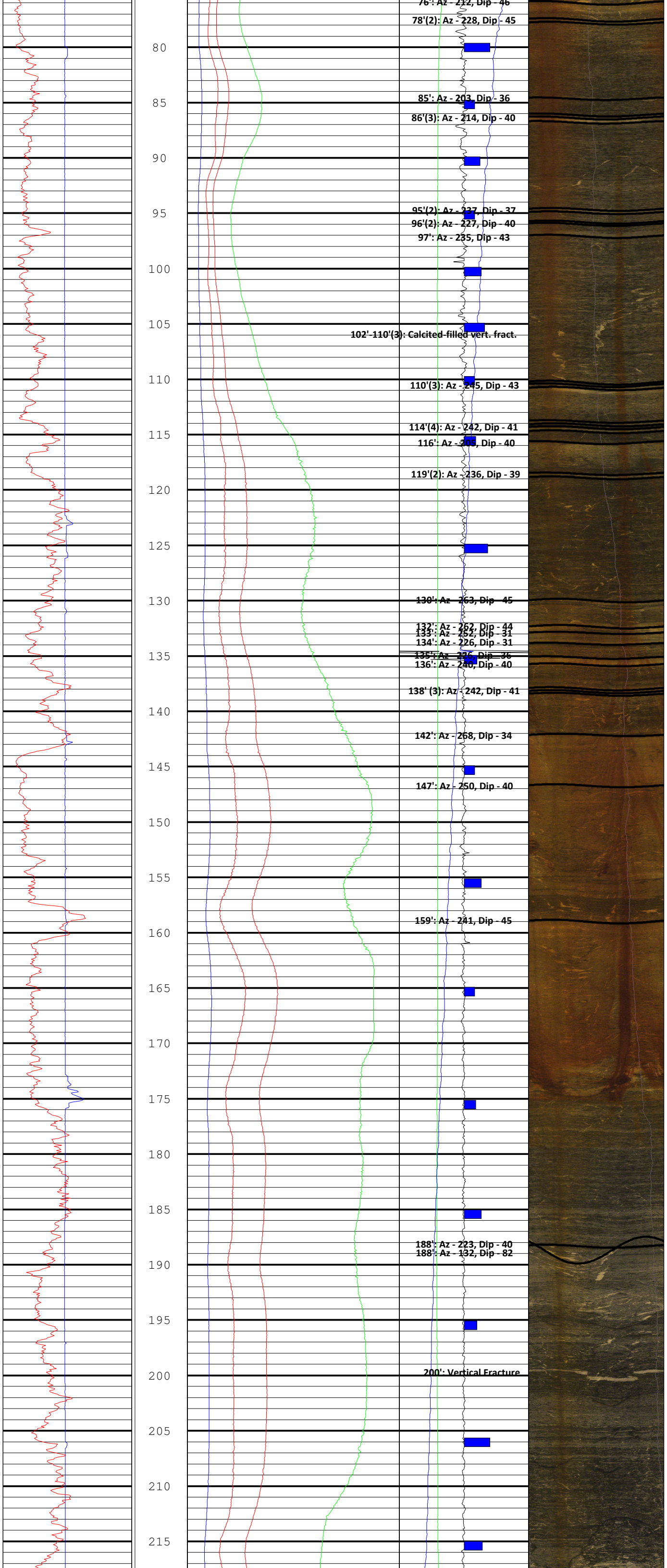
CLIENT Groundwater Sciences, Inc.			
WELL ID CW-15			
SITE			
CITY York		**STATE** PA	
LOCATION			OTHER SERVICES
SEC	TWP	RGE	
PERMANENT DATUM:	ELEVATION		K.B.
LOG MEAS. FROM: Ground Surface	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM:			G.L.

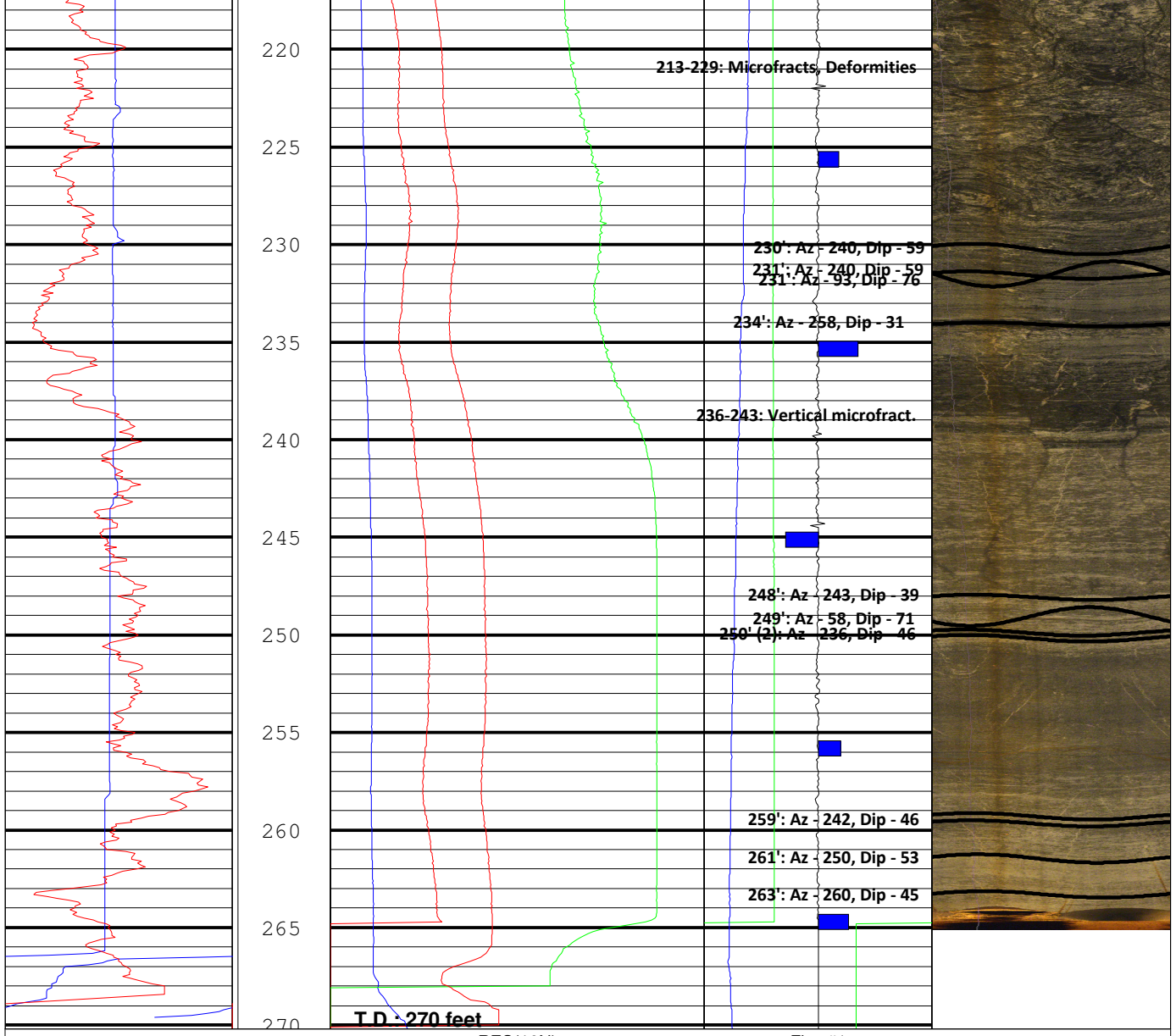
CO
WELL CW-15
SITE:ADP Site
CTY York
STE PA
FILING No

DATE	August 27, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	270 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:




76': Az - 212, Dip - 46
78'(2): Az - 228, Dip - 45
80
85
85': Az - 203, Dip - 36
86'(3): Az - 214, Dip - 40
90
95
95'(2): Az - 227, Dip - 37
96'(2): Az - 227, Dip - 40
97': Az - 235, Dip - 43
100
105
102'-110'(3): Calcited-filled vert. fract.
110
110'(3): Az - 245, Dip - 43
114'(4): Az - 242, Dip - 41
115
116': Az - 205, Dip - 40
119'(2): Az - 236, Dip - 39
120
125
130
130': Az - 263, Dip - 45
132': Az - 262, Dip - 44
133': Az - 252, Dip - 31
134': Az - 226, Dip - 31
135
135': Az - 226, Dip - 36
136': Az - 240, Dip - 40
138' (3): Az - 242, Dip - 41
140
142': Az - 268, Dip - 34
145
147': Az - 250, Dip - 40
150
155
159': Az - 241, Dip - 45
160
165
170
175
180
185
188': Az - 223, Dip - 40
188': Az - 132, Dip - 82
190
195
200
200': Vertical Fracture
205
210
215



				RES(16N)			Flow#1		
			0	OHM-M	3500	-0.06		0.06	
Flow				RES(64N)			TEMP		
-0.2	gpm	0.2	0	OHM-M	3500	57	DEG F	65	
GAM(NAT)				RES			DEL TEMP		Azimuth and Dip
0	CPS	120	0	OHM	3500	-0.5	DEG F	0.5	0° 90° 180° 270° 0°
CALIPER		Depth		LATERAL			RES(FL)		Image-NM
8	INCH	12	1ft:100ft	0	OHM-M	3500	5	OHM-M	20 0° 90° 180° 270° 0°

ADVANCED GEOLOGICAL SERVICES

3 Mystic Lane
Malvern. PA 19355
610-722-5500
610-722-0250 fax

Multi-Tool/Optical Televiewer/Caliper/Flowlog

CO
WELL MW-29
SITE:ADP Site
CTY York
STE PA
FILING No

CLIENT Groundwater Sciences, Inc.
WELL ID MW-29
SITE
CITY York **STATE** PA

LOCATION
SEC TWP RGE

OTHER SERVICES

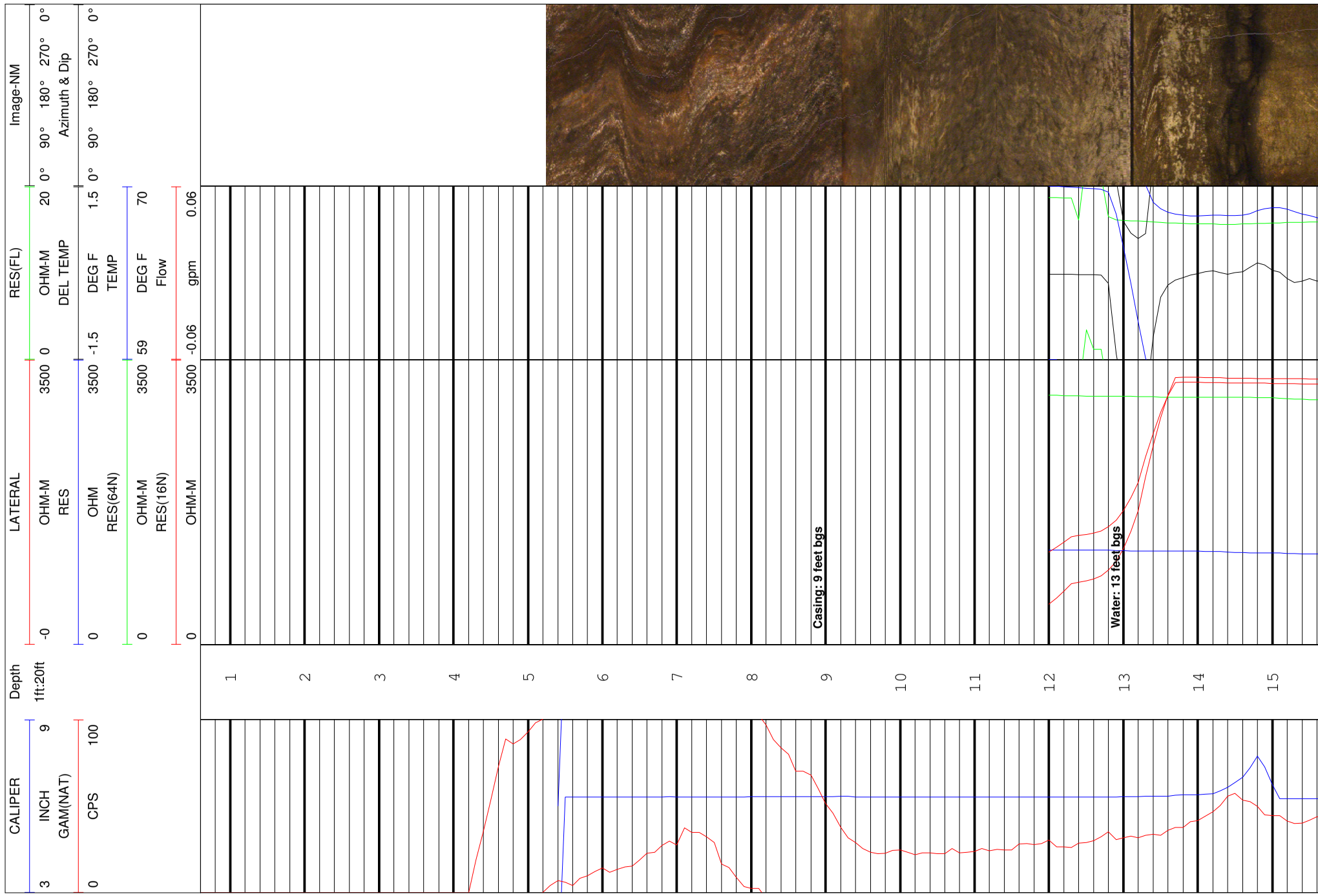
PERMANENT DATUM: ELEVATION K.B.

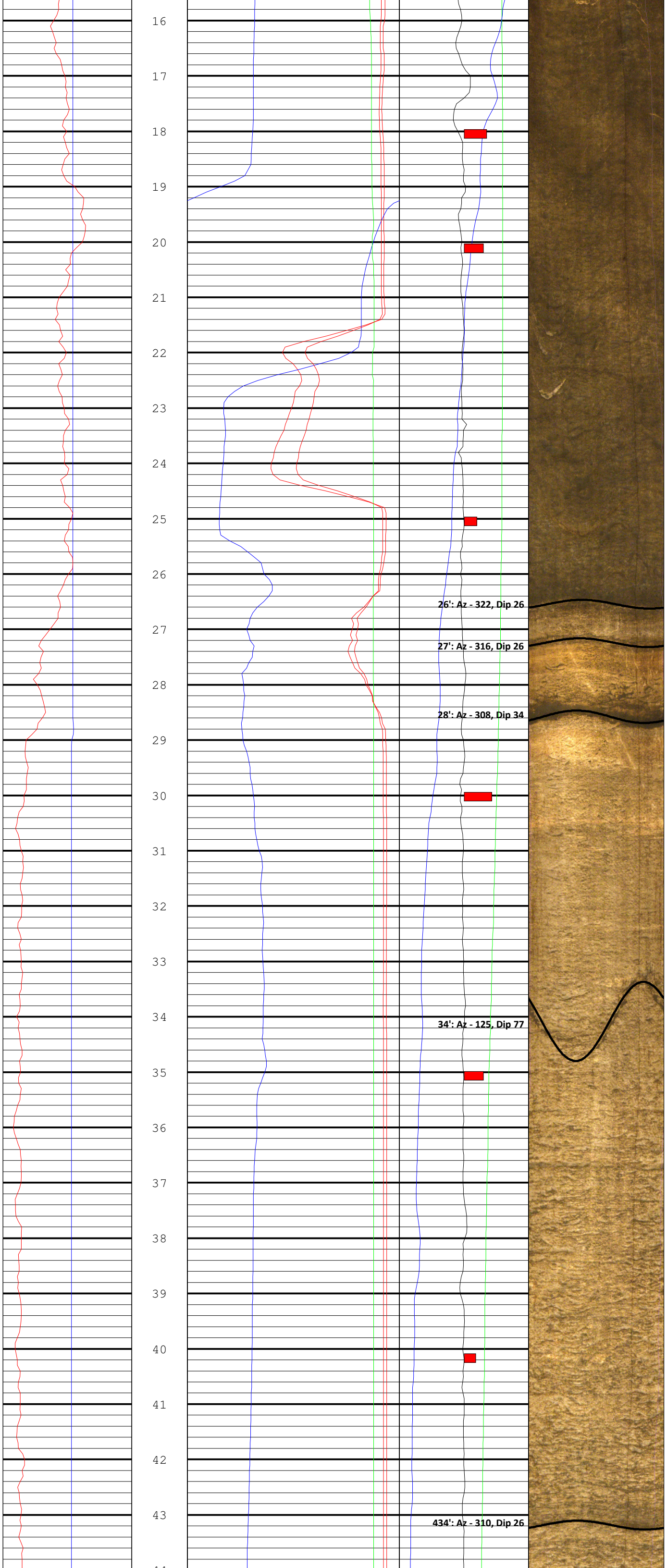
LOG MEAS. FROM: Ground Surface ABOVE PERM. DATUM D.F.

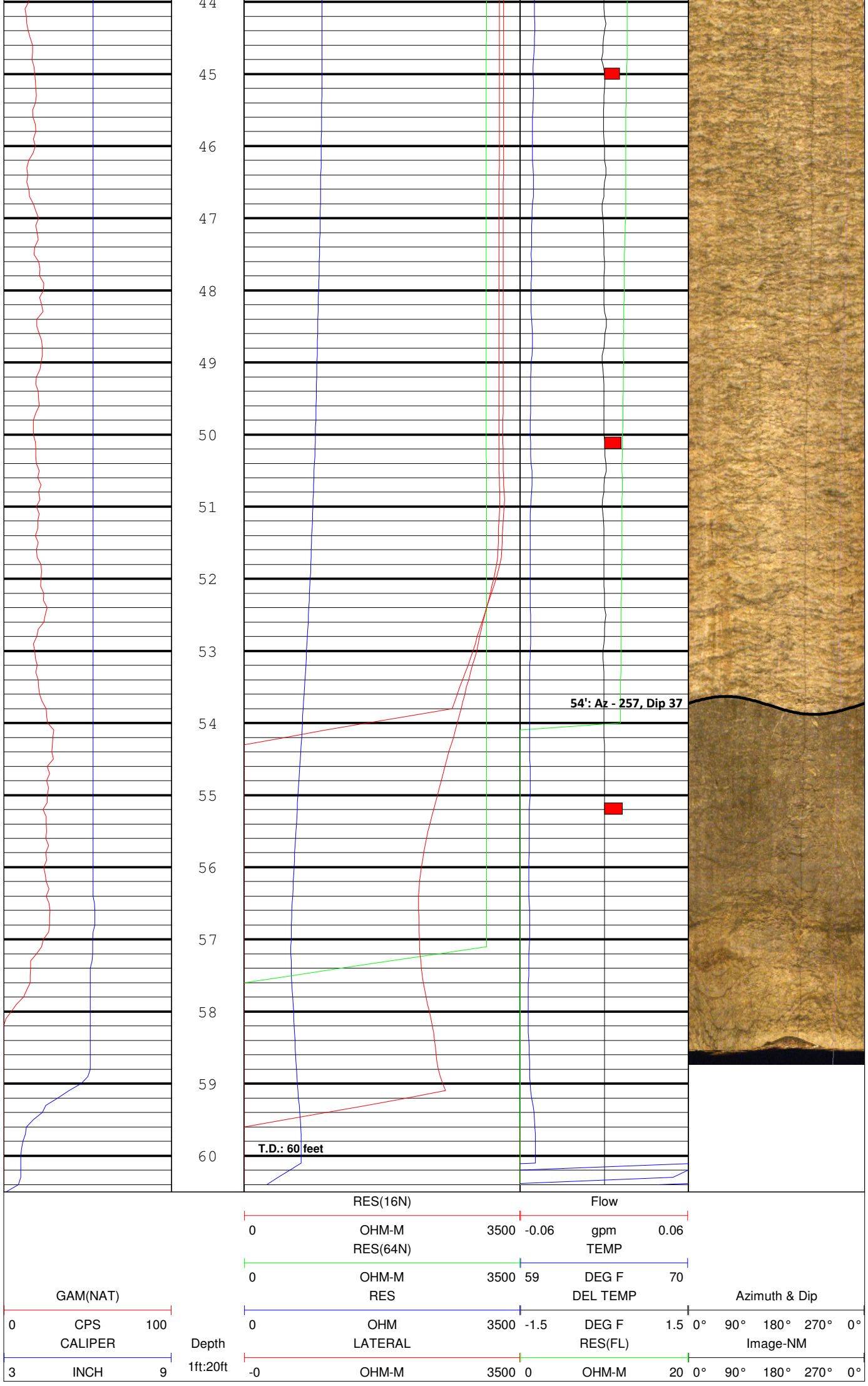
DRILLING MEAS. FROM: G.L.

DATE	September 7, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	60 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:




16
17
18
19
20
21
22
23
24
25
26
26': Az - 322, Dip 26
27
27': Az - 316, Dip 26
28
28': Az - 308, Dip 34
29
30
31
32
33
34
34': Az - 125, Dip 77
35
36
37
38
39
40
41
42
43
434': Az - 310, Dip 26
44


44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
54': Az - 257, Dip 37
T.D.: 60 feet
RES(16N)
Flow
0 OHM-M 3500 -0.06 gpm 0.06
RES(64N)
TEMP
0 OHM-M 3500 59 DEG F 70
GAM(NAT)
RES
DEL TEMP
Azimuth & Dip
0 CPS 100 0 OHM 3500 -1.5 DEG F 1.5 0° 90° 180° 270° 0°
CALIPER
Depth
LATERAL
RES(FL)
Image-NM
3 INCH 9
1ft:20ft
-0 OHM-M 3500 0 OHM-M 20 0° 90° 180° 270° 0°

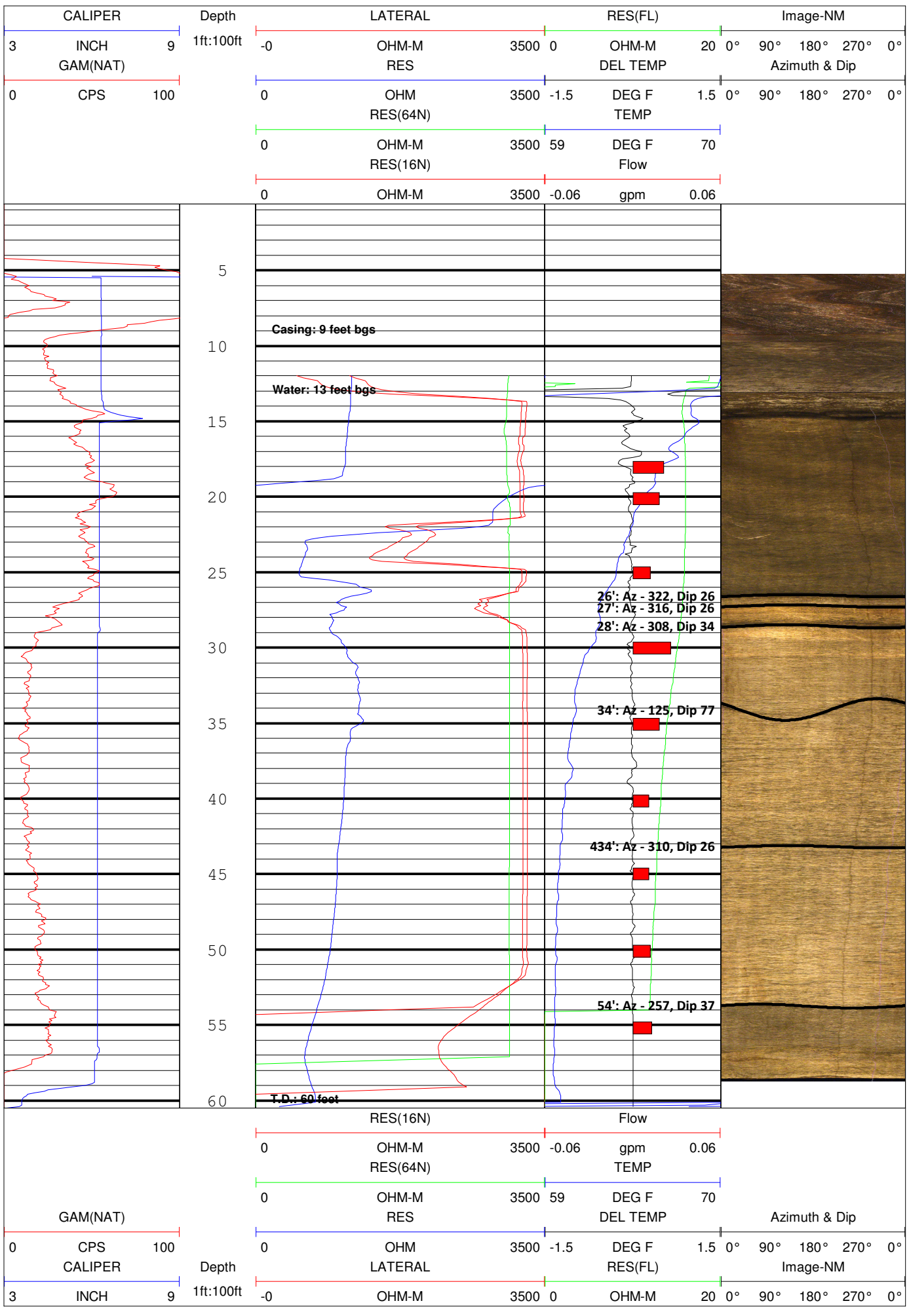
ADVANCED GEOLOGICAL SERVICES
3 Mystic Lane
Malvern, PA 19355
610-722-5500
610-722-0250 fax

Multi-Tool/Optical Televiewer/Caliper/Flowlog

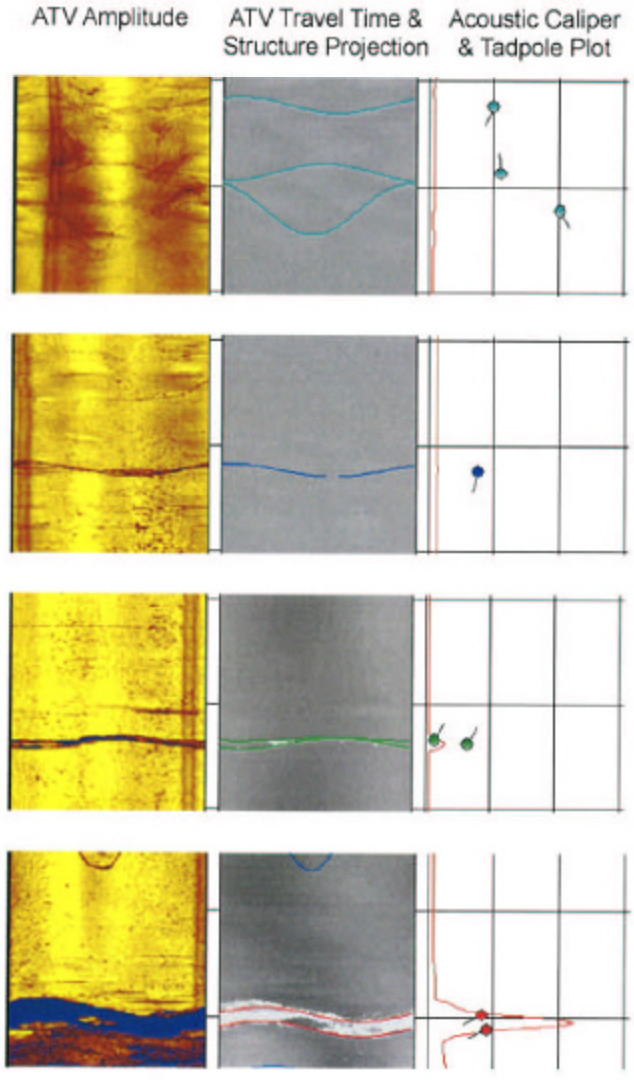
CO	**CLIENT** Groundwater Sciences, Inc.		
WELL MW-29	**WELL ID** MW-29		
SITE:ADP Site	**SITE**		
CTY York	**CITY** York	**STATE** PA	
STE PA	LOCATION		OTHER SERVICES
FILING No	SEC TWP RGE		
PERMANENT DATUM:	ELEVATION	K.B.	
LOG MEAS. FROM: Ground Surface	ABOVE PERM. DATUM	D.F.	
DRILLING MEAS. FROM:		G.L.	

DATE	September 7, 2012	TYPE FLUID IN HOLE	
RUN No		SALINITY	
TYPE LOG		DENSITY	
DEPTH-DRILLER		LEVEL	
DEPTH-LOGGER		MAX. REC. TEMP.	
BTM LOGGED INTERVAL	60 feet below TOC		
TOP LOGGED INTERVAL	5 feet		
OPERATING RIG TIME			
RECORDED BY	P. Miller		
WITNESSED BY			

REMARKS:



Appendix B



Structure Type (Symbol Color)	Observation
Fracture Rank 1 (Light Blue)	Minor Fracture (may not be continuous around the borehole)
Fracture Rank 2 (Dark Blue)	Intermediate Fracture (distinct and continuous around the borehole)
Fracture Rank 3 (Green)	Intermediate Fracture (distinct, continuous, and some aperture)
Fracture Rank 4 (Red)	Major Fracture (distinct, continuous, and significant aperture)