



M G T

Azimuths to Grid North
True North: 0.67°
Magnetic North: -8.13°

Magnetic Field
Strength: 52937.3nT
Dip Angle: 67.68°
Date: 12/18/2012
Model: GRF2010

DESIGN TARGET DETAILS

+N/S	+E/W	Nothing	Easting	Latitude
0.0	0.0	642077.38	1705018.58	40° 15' 28.94" N 80° 33' 24.775" W
Ground Level: 1160.0		Longitude		

Name: Russell Hervey
TVD: 5895
+N/S: 1479.0
+E/W: 638775.11
Nothing: 1706495.91
Easting: 40° 14' 36.726" N 80° 33' 4.900" W
Latitude: 1176.9usft MD (5959.5 TVD, -5302.3 N, 1478.7 E)
Longitude: 80° 33' 24.775" W
Shape: Point

- survey misses target center by 2.7usft at 11176.9usft MD (5959.5 TVD, -5302.3 N, 1478.7 E)

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WV GEOLOGICAL SURVEY
MORGANTOWN, WV

Cathedral Energy Services

Survey Report

Company:	Chesapeake Energy Corp	Local Co-ordinate Reference:	Well Russell Hervey BRK 8H
Project:	Brooke County, WV	TVD Reference:	WELL @ 1178.0usft (Nomac 37)
Site:	Russell Hervey	MD Reference:	WELL @ 1178.0usft (Nomac 37)
Well:	Russell Hervey BRK 8H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	Database:	USA EDM 5000 Multi Users DB

Project Brooke County, WV			
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	West Virginia North 4701		Using geodetic scale factor

Site Russell Hervey			
Site Position:	Northing:	642,082.72 usft	Latitude:
From:	Lat/Long	Easting:	40° 15' 29.000 N
Position Uncertainty:	0.0 usft	Slot Radius:	80° 33' 24.900 W
		13-3/16"	Grid Convergence:
			-0.67 °

Well Russell Hervey BRK 8H			
Well Position	+N/-S	0.0 usft	Northing:
	+E/-W	0.0 usft	642,077.30 usft
			Latitude:
Position Uncertainty	0.0 usft	Wellhead Elevation:	40° 15' 28.947 N
		usft	Longitude:
			80° 33' 24.775 W
			Ground Level:
			1,160.0 usft

Wellbore HZ					
Magnetics	Model Name	Sample Date	Declination	Dip Angle	Field Strength
	IGRF2010	12/18/2012	(°)	(°)	(nT)
			-8.80	67.68	52,937

Design HZ					
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(usft)	(usft)	(usft)	(°)	
	0.0	0.0	0.0	163.00	

Survey Program Date 1/3/2013					
From	To	Survey (Wellbore)	Tool Name	Description	
(usft)	(usft)				
100.0	5,280.0	Gyro (HZ)	Gyro	Gyro	
5,324.0	11,177.0	Survey #3 (HZ)	MWD	Geolink MWD	

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	
100.0	0.80	312.31	100.0	0.5	-0.5	-0.6	0.80	0.80	
200.0	0.59	302.19	200.0	1.2	-1.5	-1.6	0.24	-0.21	
300.0	0.59	288.81	300.0	1.7	-2.4	-2.3	0.14	0.00	
400.0	0.42	266.07	400.0	1.8	-3.2	-2.7	0.26	-0.17	
500.0	1.44	238.66	500.0	1.1	-4.7	-2.4	1.08	1.02	
600.0	2.76	240.73	599.9	-0.7	-7.9	-1.6	1.32	1.32	
700.0	4.85	250.27	699.7	-3.3	-13.9	-0.9	2.18	2.09	
800.0	6.69	245.75	799.2	-7.1	-23.2	0.0	1.89	1.84	
900.0	7.81	245.09	898.4	-12.4	-34.7	1.7	1.12	1.12	
1,000.0	8.09	243.40	997.4	-18.4	-47.2	3.8	0.36	0.28	
1,100.0	8.10	251.11	1,096.4	-23.8	-60.1	5.2	1.08	0.01	

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Well:	Russell Hervey BRK 8H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	Database:	USA EDM 5000 Multi Users DB

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
1,200.0	8.29	249.34	1,195.4	-28.7	-73.5	5.9	0.32	0.19	
1,300.0	7.39	247.72	1,294.4	-33.6	-86.2	7.0	0.93	-0.90	
1,400.0	6.89	236.30	1,393.7	-39.4	-97.2	9.3	1.50	-0.50	
1,500.0	5.92	240.59	1,493.1	-45.3	-106.6	12.1	1.08	-0.97	
1,600.0	3.46	246.44	1,592.7	-49.0	-113.9	13.6	2.50	-2.46	
1,700.0	2.87	254.92	1,692.6	-50.9	-119.1	13.8	0.75	-0.59	
1,800.0	2.58	270.27	1,792.4	-51.5	-123.8	13.1	0.78	-0.29	
1,900.0	2.03	268.34	1,892.4	-51.5	-127.8	11.9	0.56	-0.55	
2,000.0	1.53	280.06	1,992.3	-51.4	-130.9	10.9	0.62	-0.50	
2,100.0	1.31	284.48	2,092.3	-50.8	-133.3	9.7	0.25	-0.22	
2,200.0	0.84	294.71	2,192.3	-50.3	-135.1	8.6	0.51	-0.47	
2,300.0	0.73	286.73	2,292.3	-49.8	-136.3	7.7	0.15	-0.11	
2,400.0	0.79	299.04	2,392.3	-49.2	-137.5	6.9	0.17	0.06	
2,500.0	0.63	323.64	2,492.2	-48.5	-138.5	5.9	0.34	-0.16	
2,600.0	0.67	315.96	2,592.2	-47.6	-139.2	4.8	0.10	0.04	
2,700.0	0.51	325.14	2,692.2	-46.8	-139.9	3.9	0.19	-0.16	
2,800.0	0.40	337.58	2,792.2	-46.1	-140.3	3.1	0.15	-0.11	
2,900.0	0.67	340.98	2,892.2	-45.3	-140.6	2.2	0.27	0.27	
3,000.0	0.45	299.87	2,992.2	-44.5	-141.1	1.3	0.44	-0.22	
3,100.0	0.59	2.09	3,092.2	-43.8	-141.4	0.5	0.55	0.14	
3,200.0	0.33	318.42	3,192.2	-43.1	-141.6	-0.2	0.42	-0.26	
3,300.0	0.53	348.53	3,292.2	-42.4	-141.9	-0.9	0.30	0.20	
3,400.0	0.43	53.25	3,392.2	-41.7	-141.7	-1.5	0.52	-0.10	
3,500.0	0.10	4.65	3,492.2	-41.4	-141.4	-1.7	0.37	-0.33	
3,600.0	0.53	39.57	3,592.2	-41.0	-141.1	-2.1	0.45	0.43	
3,700.0	0.67	24.31	3,692.2	-40.1	-140.5	-2.8	0.21	0.14	
3,800.0	0.81	47.33	3,792.2	-39.1	-139.8	-3.5	0.33	0.14	
3,900.0	0.91	45.49	3,892.2	-38.0	-138.7	-4.2	0.10	0.10	
4,000.0	0.87	51.29	3,992.2	-37.0	-137.5	-4.8	0.10	-0.04	
4,100.0	0.68	24.85	4,092.2	-36.0	-136.7	-5.5	0.40	-0.19	
4,200.0	0.81	26.74	4,192.2	-34.8	-136.1	-6.5	0.13	0.13	
4,300.0	0.80	22.24	4,292.1	-33.5	-135.5	-7.6	0.06	-0.01	
4,400.0	0.83	29.03	4,392.1	-32.3	-134.9	-8.6	0.10	0.03	
4,500.0	0.90	33.68	4,492.1	-31.0	-134.1	-9.6	0.10	0.07	
4,600.0	0.61	33.66	4,592.1	-29.9	-133.4	-10.4	0.29	-0.29	
4,700.0	0.58	27.19	4,692.1	-29.0	-132.9	-11.1	0.07	-0.03	
4,800.0	0.73	63.32	4,792.1	-28.2	-132.1	-11.6	0.43	0.15	
4,900.0	0.81	59.80	4,892.1	-27.6	-130.9	-11.9	0.09	0.08	
5,000.0	0.89	54.18	4,992.1	-26.8	-129.7	-12.3	0.12	0.08	
5,100.0	0.88	70.00	5,092.1	-26.1	-128.3	-12.6	0.24	-0.01	
5,200.0	0.93	83.86	5,192.1	-25.7	-126.8	-12.5	0.22	0.05	
5,280.0	1.08	133.02	5,272.0	-26.2	-125.6	-11.7	1.06	0.19	Last Gyro Survey @ 5280' MD
5,324.0	0.90	147.20	5,316.0	-26.7	-125.1	-11.0	0.69	-0.41	
5,356.0	1.90	155.90	5,348.0	-27.4	-124.7	-10.2	3.19	3.13	
5,388.0	4.30	159.00	5,380.0	-29.0	-124.1	-8.5	7.52	7.50	
5,419.0	7.70	159.60	5,410.8	-32.1	-122.9	-5.3	10.97	10.97	
5,451.0	10.90	164.00	5,442.4	-37.0	-121.4	-0.1	10.24	10.00	
5,482.0	13.90	167.20	5,472.6	-43.4	-119.7	6.5	9.92	9.68	
5,514.0	16.70	166.30	5,503.5	-51.7	-117.8	15.0	8.78	8.75	
5,545.0	19.50	165.70	5,533.0	-61.0	-115.5	24.6	9.05	9.03	
5,577.0	21.50	163.90	5,562.9	-71.8	-112.5	35.8	6.55	6.25	
5,608.0	25.10	163.60	5,591.4	-83.6	-109.1	48.0	11.62	11.61	
5,639.0	27.70	164.80	5,619.2	-96.9	-105.3	61.8	8.56	8.39	

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Well: Russell Hervey BRK 8H	North Reference: Grid
Wellbore: HZ	Survey Calculation Method: Minimum Curvature
Design: HZ	Database: USA EDM 5000 Multi Users DB

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
5,675.0	31.30	166.30	5,650.5	-114.0	-100.9	79.5	10.21	10.00	
5,706.0	33.70	167.10	5,676.6	-130.2	-97.1	96.1	7.86	7.74	
5,738.0	38.00	169.20	5,702.6	-148.6	-93.3	114.8	13.97	13.44	
5,769.0	43.40	169.40	5,726.1	-168.4	-89.5	134.9	17.42	17.42	
5,800.0	48.80	170.30	5,747.6	-190.4	-85.6	157.1	17.54	17.42	
5,832.0	54.20	170.40	5,767.5	-215.1	-81.4	181.9	16.88	16.88	
5,863.0	57.90	167.00	5,784.8	-240.3	-76.3	207.5	15.01	11.94	
5,895.0	61.30	164.30	5,801.0	-267.0	-69.5	235.0	12.88	10.63	
5,927.0	64.20	164.00	5,815.6	-294.4	-61.7	263.5	9.10	9.06	
5,959.0	67.60	165.20	5,828.7	-322.5	-54.0	292.7	11.16	10.63	
5,991.0	71.90	164.10	5,839.8	-351.5	-46.0	322.7	13.82	13.44	
6,022.0	75.20	163.00	5,848.5	-380.0	-37.6	352.4	11.18	10.65	
6,054.0	76.50	161.80	5,856.4	-409.6	-28.2	383.4	5.45	4.06	
6,085.0	78.00	161.40	5,863.2	-438.3	-18.7	413.6	5.00	4.84	
6,117.0	81.00	160.50	5,869.0	-468.0	-8.4	445.1	9.77	9.38	
6,148.0	83.90	161.80	5,873.1	-497.1	1.5	475.8	10.24	9.35	
6,179.0	85.50	161.90	5,876.0	-526.4	11.1	506.7	5.17	5.16	
6,211.0	87.10	162.60	5,878.0	-556.8	20.9	538.6	5.46	5.00	
6,242.0	88.60	162.60	5,879.2	-586.4	30.1	569.6	4.84	4.84	
6,305.0	89.00	162.80	5,880.5	-646.5	48.9	632.5	0.71	0.63	
6,363.0	89.30	162.60	5,881.4	-701.9	66.1	690.5	0.62	0.52	
6,427.0	89.40	163.20	5,882.1	-763.0	84.9	754.5	0.95	0.16	
6,489.0	88.90	162.60	5,883.0	-822.3	103.2	816.5	1.26	-0.81	
6,549.0	88.80	162.80	5,884.2	-879.6	121.0	876.5	0.37	-0.17	
6,613.0	88.40	163.30	5,885.8	-940.8	139.6	940.5	1.00	-0.63	
6,676.0	88.50	163.60	5,887.5	-1,001.1	157.6	1,003.5	0.50	0.16	
6,739.0	88.20	163.50	5,889.3	-1,061.5	175.4	1,066.4	0.50	-0.48	
6,803.0	89.20	164.40	5,890.8	-1,123.0	193.1	1,130.4	2.10	1.56	
6,866.0	90.30	164.60	5,891.0	-1,183.7	209.9	1,193.4	1.77	1.75	
6,927.0	91.20	163.20	5,890.2	-1,242.3	226.9	1,254.4	2.73	1.48	
6,990.0	90.30	162.20	5,889.4	-1,302.5	245.6	1,317.4	2.14	-1.43	
7,052.0	90.20	162.30	5,889.1	-1,361.5	264.5	1,379.4	0.23	-0.16	
7,116.0	90.30	162.60	5,888.9	-1,422.5	283.8	1,443.4	0.49	0.16	
7,178.0	89.50	161.80	5,889.0	-1,481.6	302.7	1,505.3	1.82	-1.29	
7,240.0	88.30	161.30	5,890.2	-1,540.4	322.4	1,567.3	2.10	-1.94	
7,303.0	88.60	161.60	5,891.9	-1,600.1	342.4	1,630.3	0.67	0.48	
7,365.0	89.00	162.60	5,893.2	-1,659.1	361.4	1,692.2	1.74	0.65	
7,429.0	89.30	163.30	5,894.1	-1,720.2	380.2	1,756.2	1.19	0.47	
7,492.0	88.80	163.90	5,895.2	-1,780.7	398.0	1,819.2	1.24	-0.79	
7,555.0	89.20	164.50	5,896.3	-1,841.3	415.1	1,882.2	1.14	0.63	
7,619.0	88.40	163.90	5,897.6	-1,902.8	432.6	1,946.2	1.56	-1.25	
7,681.0	88.00	162.00	5,899.6	-1,962.1	450.7	2,008.1	3.13	-0.65	
7,743.0	88.20	161.80	5,901.6	-2,021.0	470.0	2,070.1	0.46	0.32	
7,807.0	88.50	162.50	5,903.4	-2,081.9	489.6	2,134.1	1.19	0.47	
7,870.0	88.50	163.20	5,905.1	-2,142.1	508.2	2,197.0	1.11	0.00	
7,932.0	88.70	163.90	5,906.6	-2,201.5	525.7	2,259.0	1.17	0.32	
7,995.0	89.50	162.90	5,907.6	-2,261.9	543.7	2,322.0	2.03	1.27	
8,058.0	88.70	162.50	5,908.6	-2,322.0	562.4	2,385.0	1.42	-1.27	
8,120.0	89.00	162.80	5,909.8	-2,381.2	580.9	2,447.0	0.68	0.48	
8,184.0	89.30	162.70	5,910.8	-2,442.3	599.9	2,511.0	0.49	0.47	
8,247.0	89.30	163.30	5,911.6	-2,502.5	618.3	2,574.0	0.95	0.00	
8,310.0	89.60	164.10	5,912.2	-2,563.0	636.0	2,637.0	1.36	0.48	
8,373.0	89.30	162.00	5,912.8	-2,623.3	654.4	2,700.0	3.37	-0.48	

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8,436.0	89.30	162.20	5,913.5	-2,683.2	673.7	2,762.9	0.32	0.00	
8,499.0	89.30	162.30	5,914.3	-2,743.2	692.9	2,825.9	0.16	0.00	
8,562.0	87.90	161.70	5,915.8	-2,803.1	712.4	2,888.9	2.42	-2.22	
8,626.0	88.00	161.60	5,918.1	-2,863.8	732.5	2,952.8	0.22	0.16	
8,690.0	87.00	161.90	5,920.9	-2,924.5	752.6	3,016.8	1.63	-1.56	
8,753.0	87.00	162.20	5,924.2	-2,984.4	771.9	3,079.7	0.48	0.00	
8,816.0	87.10	162.30	5,927.5	-3,044.3	791.1	3,142.6	0.22	0.16	
8,880.0	87.20	162.30	5,930.6	-3,105.2	810.6	3,206.5	0.16	0.16	
8,943.0	88.00	163.40	5,933.3	-3,165.3	829.1	3,269.4	2.16	1.27	
9,005.0	89.30	164.10	5,934.7	-3,224.8	846.5	3,331.4	2.38	2.10	
9,069.0	89.30	163.20	5,935.5	-3,286.2	864.5	3,395.4	1.41	0.00	
9,132.0	89.30	163.60	5,936.3	-3,346.6	882.5	3,458.4	0.63	0.00	
9,196.0	89.40	163.50	5,937.0	-3,408.0	900.6	3,522.4	0.22	0.16	
9,258.0	89.60	163.80	5,937.6	-3,467.5	918.1	3,584.4	0.58	0.32	
9,321.0	89.70	164.70	5,937.9	-3,528.1	935.2	3,647.4	1.44	0.16	
9,385.0	88.80	163.00	5,938.8	-3,589.6	953.0	3,711.4	3.01	-1.41	
9,449.0	88.70	163.10	5,940.2	-3,650.8	971.6	3,775.3	0.22	-0.16	
9,511.0	88.70	163.60	5,941.6	-3,710.2	989.4	3,837.3	0.81	0.00	
9,573.0	88.90	163.90	5,942.9	-3,769.7	1,006.7	3,899.3	0.58	0.32	
9,634.0	89.30	163.60	5,943.8	-3,828.2	1,023.8	3,960.3	0.82	0.66	
9,697.0	89.00	162.50	5,944.8	-3,888.5	1,042.1	4,023.3	1.81	-0.48	
9,758.0	89.00	162.10	5,945.8	-3,946.6	1,060.7	4,084.3	0.66	0.00	
9,819.0	89.90	161.90	5,946.4	-4,004.6	1,079.5	4,145.2	1.51	1.48	
9,881.0	89.80	160.50	5,946.6	-4,063.3	1,099.5	4,207.2	2.26	-0.16	
9,944.0	89.80	162.80	5,946.8	-4,123.1	1,119.3	4,270.2	3.65	0.00	
10,007.0	90.00	162.70	5,946.9	-4,183.3	1,138.0	4,333.2	0.35	0.32	
10,070.0	90.10	162.70	5,946.9	-4,243.4	1,156.8	4,396.2	0.16	0.16	
10,133.0	89.80	161.20	5,946.9	-4,303.3	1,176.3	4,459.2	2.43	-0.48	
10,195.0	90.20	163.10	5,946.9	-4,362.3	1,195.3	4,521.2	3.13	0.65	
10,258.0	90.50	163.20	5,946.5	-4,422.6	1,213.6	4,584.2	0.50	0.48	
10,322.0	89.00	163.60	5,946.8	-4,483.9	1,231.8	4,648.2	2.43	-2.34	
10,385.0	89.40	163.10	5,947.7	-4,544.3	1,249.9	4,711.2	1.02	0.63	
10,449.0	88.10	163.20	5,949.1	-4,605.5	1,268.4	4,775.1	2.04	-2.03	
10,512.0	88.20	163.30	5,951.1	-4,665.8	1,286.6	4,838.1	0.22	0.16	
10,573.0	88.80	163.30	5,952.7	-4,724.2	1,304.1	4,899.1	0.98	0.98	
10,636.0	89.30	163.90	5,953.8	-4,784.7	1,321.9	4,962.1	1.24	0.79	
10,697.0	89.70	164.30	5,954.3	-4,843.3	1,338.6	5,023.1	0.93	0.66	
10,758.0	89.10	163.20	5,954.9	-4,901.9	1,355.7	5,084.0	2.05	-0.98	
10,820.0	89.00	163.10	5,956.0	-4,961.2	1,373.6	5,146.0	0.23	-0.16	
10,884.0	89.40	163.30	5,956.9	-5,022.5	1,392.1	5,210.0	0.70	0.63	
10,946.0	89.70	162.80	5,957.3	-5,081.8	1,410.2	5,272.0	0.94	0.48	
11,009.0	89.30	162.60	5,957.9	-5,141.9	1,428.9	5,335.0	0.71	-0.63	
11,072.0	89.30	162.70	5,958.7	-5,202.1	1,447.7	5,398.0	0.16	0.00	
11,122.0	89.60	162.90	5,959.1	-5,249.8	1,462.5	5,448.0	0.72	0.60	Last Cathedral Survey @ 11122' MD
11,177.0	89.60	162.90	5,959.5	-5,302.4	1,478.7	5,503.0	0.00	0.00	Projection to Bit @ 11177' MD

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WV GEOLOGICAL SURVEY
MORGANTOWN, WV

Cathedral Energy Services

Survey Report

Company:	Chesapeake Energy Corp	Local Co-ordinate Reference:	Well Russell Hervey BRK 8H
Project:	Brooke County, WV	TVD Reference:	WELL @ 1178.0usft (Nomac 37)
Site:	Russell Hervey	MD Reference:	WELL @ 1178.0usft (Nomac 37)
Well:	Russell Hervey BRK 8H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	Database:	USA EDM 5000 Multi Users DB

Targets									
Target Name	Dip Angle	Dip Dir.	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
- hit/miss target	(°)	(°)	(usft)	(usft)	(usft)	(usft)	(usft)		
Russell Hervey 8H PBHI	0.00	360.00	5,962.2	-5,302.2	1,479.0	636,775.11	1,706,495.91	40° 14' 36.726 N	80° 33' 4.900 W
- actual wellpath misses target center by 2.7usft at 11176.9usft MD (5959.5 TVD, -5302.3 N, 1478.7 E)									
- Point									
Russell Hervey 8H PBHI	0.00	360.00	5,947.2	-5,302.2	1,479.0	636,775.11	1,706,495.91	40° 14' 36.726 N	80° 33' 4.900 W
- actual wellpath misses target center by 12.3usft at 11176.8usft MD (5959.5 TVD, -5302.2 N, 1478.6 E)									
- Point									

Design Annotations					
Measured Depth	Vertical Depth	Local Coordinates		Comment	
(usft)	(usft)	+N/-S	+E/-W		
(usft)	(usft)	(usft)	(usft)		
5,280.0	5,272.0	-26.2	-125.6	Last Gyro Survey @ 5280' MD	
11,122.0	5,959.1	-5,249.8	1,462.5	Last Cathedral Survey @ 11122' MD	
11,177.0	5,959.5	-5,302.4	1,478.7	Projection to Bit @ 11177' MD	

Checked By: _____ Approved By: _____ Date: _____

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