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**IM OIL CONSERVATION
ARTESIA DISTRICT**

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Hadaway Consulting & Eng. LLC

Chaves County, NM (NAD 83)

Pinehurst 5H

Pinehurst 5H

30.005-64299

Pinehurst 5H

Survey: DrilTech MWD

Standard Survey Report

18 December, 2018



Survey Report

Company: Hadaway Consulting & Eng. LLC
Project: Chaves County, NM (NAD 83)
Site: Pinehurst 5H
Well: Pinehurst 5H
Wellbore: Pinehurst 5H
Design: Pinehurst 5H

Local Co-ordinate Reference: Well Pinehurst 5H
TVD Reference: 3662.3' + 17' KBE @ 3679.30ft (Rig: Silver Oak 1)
MD Reference: 3662.3' + 17' KBE @ 3679.30ft (Rig: Silver Oak 1)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: EDM 5000.14 Single User Db

Project	Chaves County, NM (NAD 83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site	Pinehurst 5H				
Site Position:		Northing:	857,749.50 usft	Latitude:	33° 21' 27.870 N
From:	Map	Easting:	599,751.10 usft	Longitude:	104° 8' 31.281 W
Position Uncertainty:	0.00 ft	Slot Radius:	13.200 in	Grid Convergence:	0.11 °

Well	Pinehurst 5H, N Section 21 T11S - R28E (BHL)					
Well Position	+N/-S	0.00 ft	Northing:	857,749.50 usft	Latitude:	33° 21' 27.870 N
	+E/-W	0.00 ft	Easting:	599,751.10 usft	Longitude:	104° 8' 31.281 W
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	3,662.30 ft

Wellbore	Pinehurst 5H				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	11/15/2018	7.16	60.98	48,397.74186076

Design	Pinehurst 5H				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	181.05	

Survey Program	Date 12/18/2018				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
125.00	568.00	Invictus Surveys (Pinehurst 5H)	MWD	MWD - Standard	
619.00	6,861.00	DrilTech MWD (Pinehurst 5H)	MWD	MWD - Standard	

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
568.00	1.20	155.07	567.89	-10.38	0.85	10.36	0.00	0.00	0.00
568'MD: Tie into INVICTVS Surveys									
619.00	1.41	168.86	618.88	-11.48	1.20	11.45	0.74	0.41	27.04
619'MD: Start DrilTech MWD									
635.00	1.23	170.35	634.88	-11.84	1.27	11.81	1.15	-1.13	9.31
666.00	1.14	194.87	665.87	-12.46	1.24	12.44	1.65	-0.29	79.10
697.00	1.58	230.38	696.86	-13.04	0.84	13.02	3.00	1.42	114.55
728.00	2.64	249.72	727.84	-13.56	-0.16	13.56	4.07	3.42	62.39



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Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
759.00	3.69	255.60	758.79	-14.05	-1.80	14.08	3.54	3.39	18.97
791.00	4.48	262.90	790.71	-14.46	-4.04	14.53	2.95	2.47	22.81
822.00	5.72	268.79	821.59	-14.64	-6.78	14.77	4.34	4.00	19.00
854.00	6.51	273.53	853.41	-14.57	-10.19	14.75	2.93	2.47	14.81
884.00	7.39	277.23	883.19	-14.22	-13.80	14.47	3.29	2.93	12.33
915.00	8.27	279.60	913.90	-13.60	-17.97	13.92	3.02	2.84	7.65
946.00	9.15	279.69	944.54	-12.81	-22.60	13.22	2.84	2.84	0.29
977.00	9.76	278.98	975.12	-11.98	-27.63	12.49	2.00	1.97	-2.29
1,009.00	10.55	278.63	1,006.62	-11.12	-33.20	11.73	2.48	2.47	-1.09
1,040.00	11.70	278.02	1,037.03	-10.26	-39.12	10.97	3.73	3.71	-1.97
1,070.00	12.40	277.31	1,066.37	-9.42	-45.33	10.25	2.39	2.33	-2.37
1,100.00	12.66	276.87	1,095.66	-8.62	-51.79	9.57	0.92	0.87	-1.47
1,130.00	12.93	273.97	1,124.91	-7.99	-58.40	9.06	2.32	0.90	-9.67
1,162.00	13.01	271.60	1,156.10	-7.64	-65.57	8.85	1.68	0.25	-7.41
1,192.00	12.66	268.17	1,185.35	-7.66	-72.23	8.98	2.79	-1.17	-11.43
1,222.00	11.96	262.64	1,214.66	-8.16	-78.60	9.60	4.57	-2.33	-18.43
1,253.00	11.78	262.11	1,245.00	-9.00	-84.92	10.56	0.68	-0.58	-1.71
1,283.00	11.61	261.32	1,274.37	-9.88	-90.94	11.55	0.78	-0.57	-2.63
1,314.00	11.70	258.94	1,304.73	-10.95	-97.11	12.73	1.58	0.29	-7.68
1,344.00	11.78	255.60	1,334.11	-12.30	-103.06	14.19	2.28	0.27	-11.13
1,375.00	12.57	253.76	1,364.41	-14.03	-109.36	16.03	2.84	2.55	-5.94
1,405.00	13.63	253.93	1,393.63	-15.92	-115.89	18.04	3.54	3.53	0.57
1,436.00	15.21	253.32	1,423.65	-18.10	-123.30	20.36	5.12	5.10	-1.97
1,467.00	16.71	249.54	1,453.46	-20.83	-131.37	23.23	5.88	4.84	-12.19
1,498.00	17.50	245.15	1,483.09	-24.34	-139.78	26.90	4.88	2.55	-14.16
1,529.00	18.29	239.26	1,512.59	-28.79	-148.19	31.50	6.37	2.55	-19.00
1,560.00	18.55	232.23	1,542.00	-34.29	-156.27	37.15	7.21	0.84	-22.68
1,590.00	18.91	223.26	1,570.42	-40.76	-163.37	43.75	9.67	1.20	-29.90
1,620.00	19.26	215.70	1,598.78	-48.32	-169.59	51.42	8.32	1.17	-25.20
1,651.00	20.66	206.83	1,627.92	-57.35	-175.05	60.55	10.75	4.52	-28.61
1,682.00	23.13	201.02	1,656.68	-67.92	-179.70	71.20	10.59	7.97	-18.74
1,712.00	24.89	196.89	1,684.09	-79.46	-183.65	82.81	8.11	5.87	-13.77
1,743.00	27.26	191.88	1,711.94	-92.66	-187.01	96.07	10.43	7.65	-16.16
1,774.00	29.55	188.90	1,739.20	-107.16	-189.65	110.62	8.69	7.39	-9.61
1,805.00	32.01	186.61	1,765.84	-122.87	-191.78	126.37	8.79	7.94	-7.39
1,836.00	34.12	186.52	1,791.81	-139.68	-193.71	143.20	6.81	6.81	-0.29
1,867.00	36.84	186.87	1,817.06	-157.54	-195.81	161.11	8.80	8.77	1.13
1,898.00	39.31	185.82	1,841.46	-176.54	-197.92	180.14	8.24	7.97	-3.39
1,929.00	42.56	185.29	1,864.87	-196.76	-199.88	200.39	10.54	10.48	-1.71
1,958.00	45.90	184.94	1,885.65	-216.90	-201.68	220.56	11.55	11.52	-1.21
1,989.00	48.36	185.38	1,906.74	-239.53	-203.73	243.22	8.00	7.94	1.42
2,016.00	50.30	185.91	1,924.33	-259.91	-205.74	263.63	7.34	7.19	1.96



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Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
2,052.00	51.00	185.73	1,947.16	-287.60	-208.57	291.37	1.98	1.94	-0.50
2,082.00	50.56	185.56	1,966.13	-310.73	-210.85	314.54	1.53	-1.47	-0.57
2,113.00	50.12	185.47	1,985.91	-334.48	-213.15	338.33	1.44	-1.42	-0.29
2,144.00	50.21	185.38	2,005.77	-358.18	-215.40	362.07	0.37	0.29	-0.29
2,166.00	50.39	185.56	2,019.82	-375.03	-217.01	378.95	1.03	0.82	0.82
2,176.00	50.74	185.73	2,026.18	-382.72	-217.77	386.64	3.74	3.50	1.70
2,207.00	54.08	185.64	2,045.08	-407.16	-220.20	411.12	10.78	10.77	-0.29
2,238.00	57.51	185.73	2,062.51	-432.67	-222.74	436.67	11.07	11.06	0.29
2,268.00	59.71	185.91	2,078.13	-458.14	-225.34	462.19	7.35	7.33	0.60
2,299.00	62.78	185.29	2,093.04	-485.19	-227.99	489.28	10.06	9.90	-2.00
2,330.00	65.33	185.29	2,106.61	-512.94	-230.56	517.08	8.23	8.23	0.00
2,353.00	68.15	184.76	2,115.69	-533.99	-232.41	538.16	12.44	12.26	-2.30
2,431.00	72.98	184.50	2,141.63	-607.28	-238.34	611.55	6.20	6.19	-0.33
2,461.00	76.50	184.41	2,149.53	-636.13	-240.59	640.43	11.74	11.73	-0.30
2,492.00	79.23	184.94	2,156.05	-666.34	-243.06	670.68	8.96	8.81	1.71
2,523.00	81.34	185.29	2,161.28	-696.77	-245.79	701.15	6.90	6.81	1.13
2,554.00	83.36	185.82	2,165.40	-727.35	-248.76	731.78	6.73	6.52	1.71
2,584.00	85.91	184.76	2,168.21	-757.08	-251.51	761.57	9.20	8.50	-3.53
2,586.00	86.04	184.79	2,168.35	-759.07	-251.68	763.56	6.74	6.52	1.71
2586' MD: Pinehurst FTP (Interpolated Depth) - 867' FNL - 1273' MD: FEL - Pinehurst 5H FTP (as drilled)									
2,615.00	87.93	185.29	2,169.87	-787.92	-254.22	792.44	6.74	6.52	1.71
2,646.00	90.13	185.56	2,170.40	-818.77	-257.15	823.35	7.15	7.10	0.87
2,677.00	91.63	183.62	2,169.92	-849.67	-259.63	854.28	7.91	4.84	-6.26
2,708.00	92.59	183.97	2,168.78	-880.58	-261.69	885.23	3.30	3.10	1.13
2,739.00	91.71	181.34	2,167.62	-911.52	-263.12	916.19	8.94	-2.84	-8.48
2,769.00	91.36	180.37	2,166.81	-941.51	-263.57	946.18	3.44	-1.17	-3.23
2,861.00	91.01	178.35	2,164.91	-1,033.48	-262.54	1,038.11	2.23	-0.38	-2.20
2,953.00	88.72	175.54	2,165.13	-1,125.33	-257.64	1,129.86	3.94	-2.49	-3.05
3,045.00	89.96	178.44	2,166.19	-1,217.18	-252.81	1,221.61	3.43	1.35	3.15
3,137.00	90.13	179.14	2,166.12	-1,309.16	-250.87	1,313.54	0.78	0.18	0.76
3,230.00	90.13	177.73	2,165.90	-1,402.13	-248.33	1,406.44	1.52	0.00	-1.52
3,322.00	87.76	177.56	2,167.60	-1,494.03	-244.55	1,498.26	2.58	-2.58	-0.18
3,415.00	91.28	178.35	2,168.38	-1,586.95	-241.23	1,591.10	3.88	3.78	0.85
3,506.00	89.43	177.73	2,167.81	-1,677.89	-238.12	1,681.97	2.14	-2.03	-0.68
3,598.00	89.16	176.33	2,168.95	-1,769.76	-233.35	1,773.74	1.55	-0.29	-1.52
3,690.00	92.07	178.35	2,167.96	-1,861.64	-229.08	1,865.52	3.85	3.16	2.20
3,782.00	92.68	179.67	2,164.15	-1,953.54	-227.49	1,957.38	1.58	0.66	1.43
3,876.00	91.63	179.32	2,160.61	-2,047.47	-226.66	2,051.28	1.18	-1.12	-0.37
3,971.00	91.01	179.05	2,158.42	-2,142.43	-225.31	2,146.20	0.71	-0.65	-0.28
4,065.00	90.04	180.55	2,157.56	-2,236.43	-224.99	2,240.17	1.90	-1.03	1.60
4,159.00	90.75	182.13	2,156.91	-2,330.40	-227.18	2,334.17	1.84	0.76	1.68
4,292.00	87.58	179.84	2,158.85	-2,463.34	-229.47	2,467.13	2.94	-2.38	-1.72



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Database: EDM 5000.14 Single User Db

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
4,387.00	88.64	179.58	2,161.98	-2,558.28	-228.99	2,562.05	1.15	1.12	-0.27
4,480.00	88.11	178.61	2,164.62	-2,651.23	-227.52	2,654.95	1.19	-0.57	-1.04
4,574.00	87.05	179.32	2,168.59	-2,745.13	-225.82	2,748.81	1.36	-1.13	0.76
4,669.00	87.05	180.11	2,173.48	-2,840.00	-225.35	2,843.65	0.83	0.00	0.83
4,763.00	86.44	180.55	2,178.82	-2,933.85	-225.89	2,937.49	0.80	-0.65	0.47
4,858.00	86.53	179.32	2,184.64	-3,028.67	-225.79	3,032.30	1.30	0.09	-1.29
4,952.00	88.02	181.69	2,189.11	-3,122.55	-226.61	3,126.18	2.98	1.59	2.52
5,046.00	89.43	181.25	2,191.20	-3,216.49	-229.02	3,220.15	1.57	1.50	-0.47
5,140.00	91.54	182.66	2,190.41	-3,310.43	-232.23	3,314.13	2.70	2.24	1.50
5,232.00	91.01	183.45	2,188.36	-3,402.27	-237.13	3,406.04	1.03	-0.58	0.86
5,324.00	90.40	181.78	2,187.23	-3,494.16	-241.33	3,498.00	1.93	-0.66	-1.82
5,417.00	90.92	180.99	2,186.16	-3,587.13	-243.58	3,590.99	1.02	0.56	-0.85
5,509.00	88.72	178.52	2,186.45	-3,679.12	-243.18	3,682.95	3.60	-2.39	-2.68
5,601.00	89.60	178.96	2,187.79	-3,771.08	-241.16	3,774.87	1.07	0.96	0.48
5,693.00	90.48	179.40	2,187.73	-3,863.07	-239.84	3,866.82	1.07	0.96	0.48
5,785.00	91.28	180.46	2,186.32	-3,955.06	-239.73	3,958.79	1.44	0.87	1.15
5,878.00	91.19	180.19	2,184.31	-4,048.04	-240.26	4,051.76	0.31	-0.10	-0.29
5,970.00	91.19	181.07	2,182.40	-4,140.01	-241.27	4,143.74	0.96	0.00	0.96
6,063.00	90.75	181.16	2,180.83	-4,232.98	-243.08	4,236.72	0.48	-0.47	0.10
6,155.00	90.40	181.60	2,179.90	-4,324.95	-245.30	4,328.72	0.61	-0.38	0.48
6,247.00	89.87	181.16	2,179.69	-4,416.92	-247.51	4,420.71	0.75	-0.58	-0.48
6,339.00	90.04	180.99	2,179.76	-4,508.90	-249.24	4,512.71	0.26	0.18	-0.18
6,430.00	91.54	180.37	2,178.51	-4,599.88	-250.32	4,603.70	1.78	1.65	-0.68
6,521.00	92.07	180.55	2,175.64	-4,690.84	-251.05	4,694.65	0.62	0.58	0.20
6,615.00	90.92	181.07	2,173.19	-4,784.79	-252.38	4,788.61	1.34	-1.22	0.55
6,710.00	89.08	180.81	2,173.19	-4,879.78	-253.93	4,883.61	1.96	-1.94	-0.27
6,804.00	91.01	180.72	2,173.11	-4,973.76	-255.19	4,977.60	2.06	2.05	-0.10
6804'MD: Final MWD Survey									
6,861.00	91.01	180.72	2,172.11	-5,030.75	-255.91	5,034.59	0.00	0.00	0.00
6861'MD: 137' FSL - 1345' FWL - Bottom Hole - 6861'MD: Projection to Total Depth - Pinehurst 5H PBHL - Pinehurst 5H I									

Design Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
Pinehurst 5H FTP (as	0.00	0.01	2,168.35	-759.07	-251.68	856,990.43	599,499.43	33° 21' 20.364 N	104° 8' 34.265 W
- survey hits target center									
- Point									
Pinehurst 5H BHL (as	0.00	0.00	2,172.11	-5,030.75	-255.91	852,718.76	599,495.20	33° 20' 38.099 N	104° 8' 34.407 W
- survey hits target center									
- Point									



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Well:	Pinehurst 5H	North Reference:	Grid
Wellbore:	Pinehurst 5H	Survey Calculation Method:	Minimum Curvature
Design:	Pinehurst 5H	Database:	EDM 5000.14 Single User Db

Survey Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
568.00	567.89	-10.38	0.85	568'MD: Tie into INVICTVS Surveys
619.00	618.88	-11.48	1.20	619'MD: Start DriTech MWD
2,586.00	2,168.35	-759.07	-251.68	2586'MD: Pinehurst FTP (Interpolated Depth) - 867' FNL - 1273'MD: FE
6,804.00	2,173.11	-4,973.76	-255.19	6804'MD: Final MWD Survey
6,861.00	2,172.11	-5,030.75	-255.91	6861'MD: 137' FSL - 1345' FWL - Bottom Hole
6,861.00	2,172.11	-5,030.75	-255.91	6861'MD: Projection to Total Depth

Checked By: _____	Approved By: _____	Date: _____
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Hadaway Consulting & Eng. LLC
Chaves County, NM (NAD 83)

Pinehurst 5H
Pinehurst 5H
Pinehurst 5H
Rig: Silver Oak 1

SURFACE LOCATION

US State Plane 1983
New Mexico Eastern Zone
Elevation: 3662.3' ± 17' KBE @ 3679.30ft (Rig: Silver Oak 1)
Northing 857749.50 Easting 599751.10 Latitude 33° 21' 27.870 N Longitude 104° 8' 31.281 W

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

Name	TVD	+N/-S	+E/-W	Northing	Easting
Pinehurst 5H FTP (as drilled)	2168.35	-759.07	-251.68	856990.43	599499.42
Pinehurst 5H BHL (as drilled)	2172.11	-5030.75	-255.91	852718.76	599495.19

FORMATION TOP DETAILS

No formation data is available



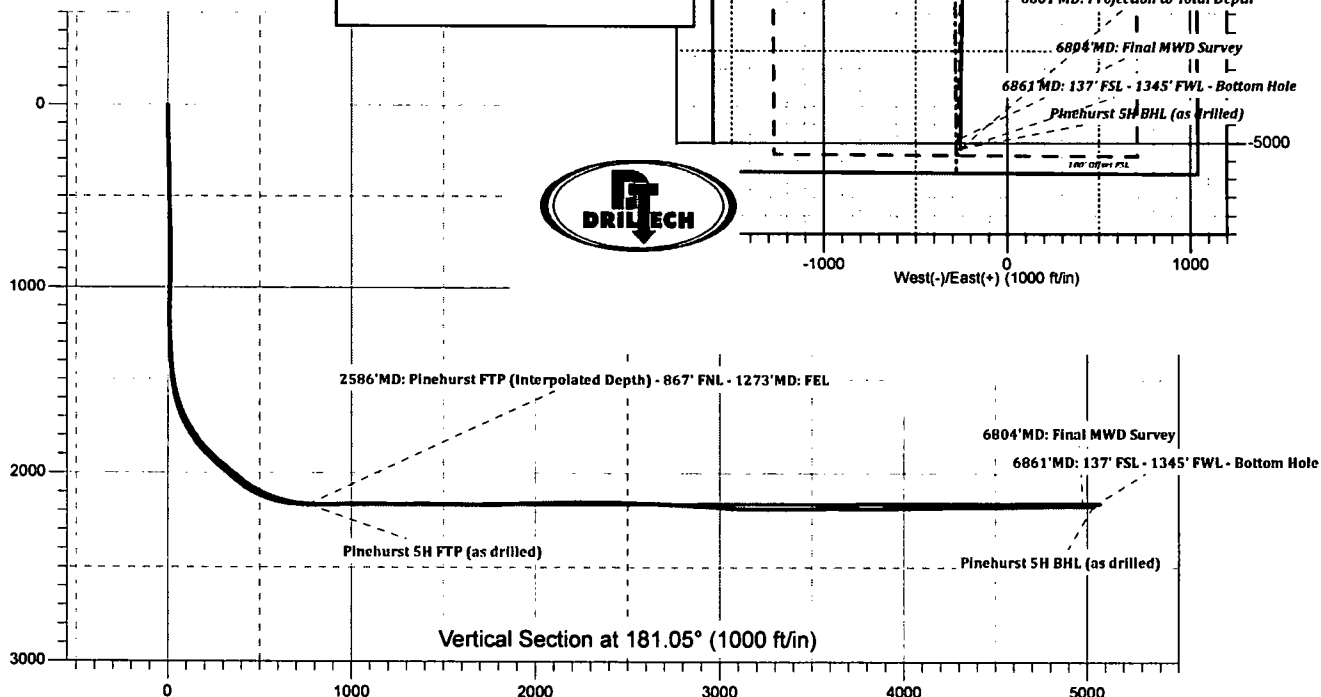
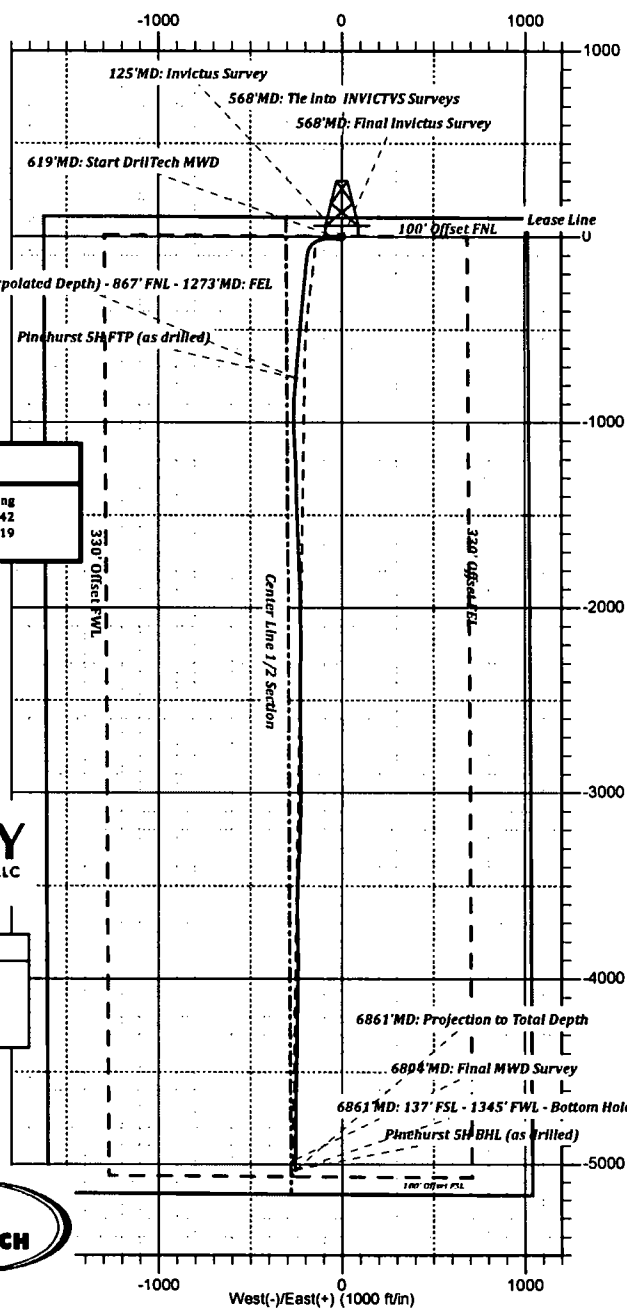
HADAWAY
CONSULTING & ENGINEERING, LLC

CASING DETAILS

No casing data is available



Adjustment to Grid North
True North -0.10°
Magnetic North 7.85°
Magnetic Field
Strength 46397.2uT
Dip Angle -66.98°
Date: 11/15/2019
Model: IGR2015



Vertical Section at 181.05° (1000 ft/in)