WMC 24-17 Pad
WMC 431-20
Well WMC 431-20 - Slot WMC 431-20, True North
Surveys

Terra Energy Partners, LLP
WMC 431-20
Garfield County, CO (Nad 83)
KB=30' @ 8898.0ft

PROJECT DETAILS: Garfield County, CO (Nad 83)

Geodetic System: US State Plane 1983
Datum: North American Datum 1983
Ellipsoid: GRS 1980
Zone: Colorado Central Zone

System Datum: Mean Sea Level

WELL DETAILS: WMC 431-20

Ground Level: 8868.0

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	1593022.100	2350645.600	39.439050	-107.799425	WMC 431-20

DESIGN TARGET DETAILS

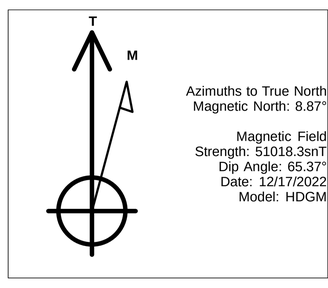
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
KMV	8838.0	-972.9	1365.3	1592015.000	2351985.800	39.436379	-107.794591
PBHL	10988.0	-972.9	1365.3	1592015.000	2351985.800	39.436379	-107.794591

ANNOTATIONS

TVD	MD	Inc	Azi	+N/-S	+E/-W	VSect	Departure	Annotation
297.7	298.0	4.61	114.85	-5.0	10.9	11.8	12.0	First Survey @ 298 MD/ 297.7 TVD
10846.1	11019.0	1.18	249.41	-978.6	1373.8	1686.7	1734.6	PTB @ 11019 MD/ 10846.1 TVD

SLOTS

Slot Name	+N/-S	+E/-W	Northing	Easting
WMC 11-20	18.7	-49.1	1593042.000	2350597.000
WMC 12-20	13.3	-35.0	1593036.300	2350610.900
WMC 13-20	8.0	-21.0	1593030.600	2350624.800
WMC 311-20	9.3	-52.7	1593032.700	2350593.200
WMC 312-20	3.9	-38.6	1593027.000	2350607.100
WMC 32-20	5.3	-14.0	1593027.800	2350631.700
WMC 331-20	-2.6	7.1	1593019.300	2350652.600
WMC 33-20	-1.3	-24.6	1593021.400	2350621.000
WMC 332-20	-9.3	-3.6	1593012.900	2350641.800
WMC 411-20	15.9	-42.0	1593039.100	2350604.000
WMC 412-20	10.7	-28.1	1593033.500	2350617.800
WMC 431-20	0.0	0.0	1593022.100	2350645.600
WMC 432-20	-6.7	-10.5	1593015.700	2350634.900
WMC 511-20	6.6	-45.6	1593029.900	2350600.200
WMC 512-20	1.3	-31.5	1593024.200	2350614.100
WMC 531-20	2.7	-7.0	1593025.000	2350638.700
WMC 532-20	-4.0	-17.5	1593018.500	2350628.000

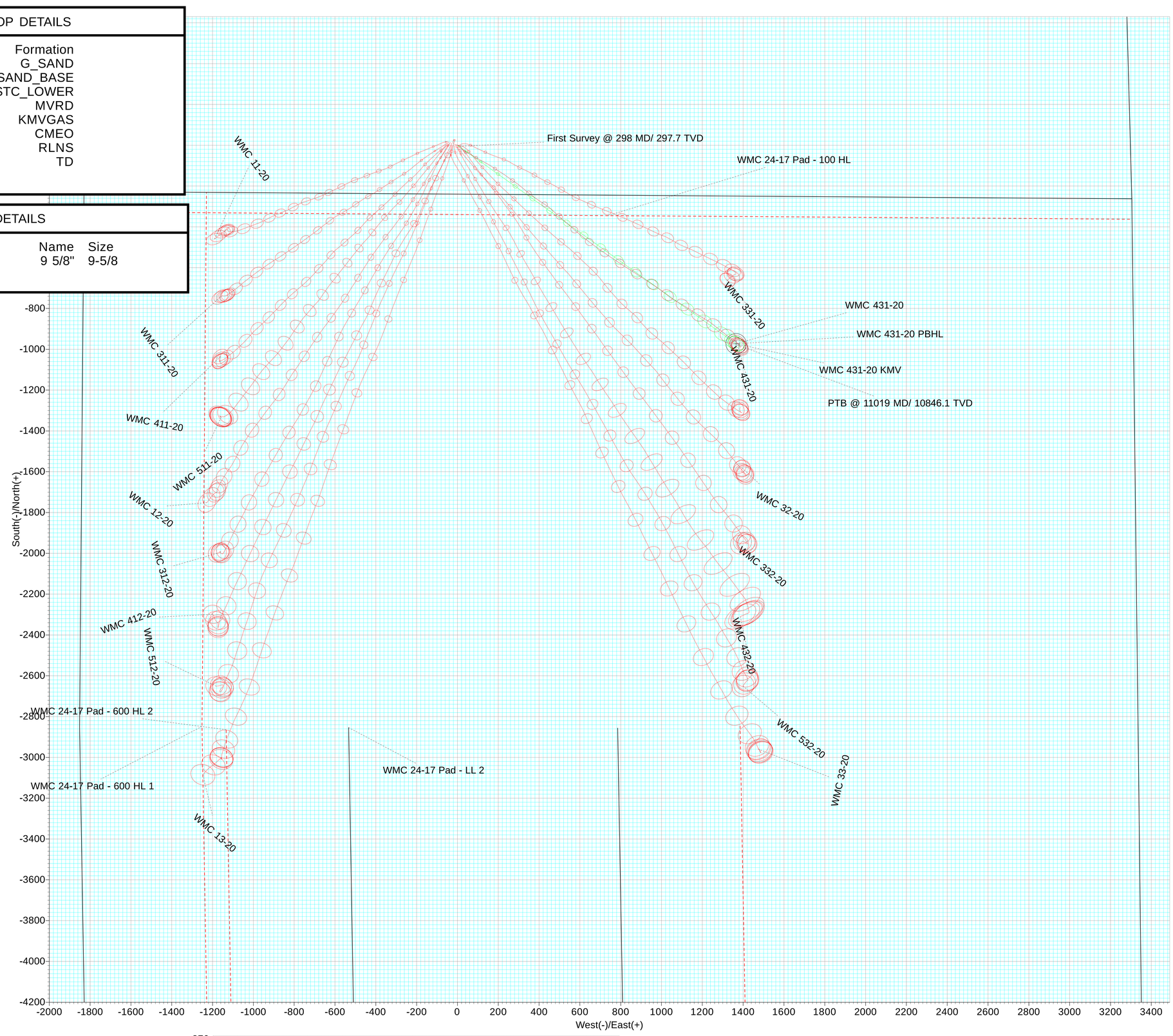


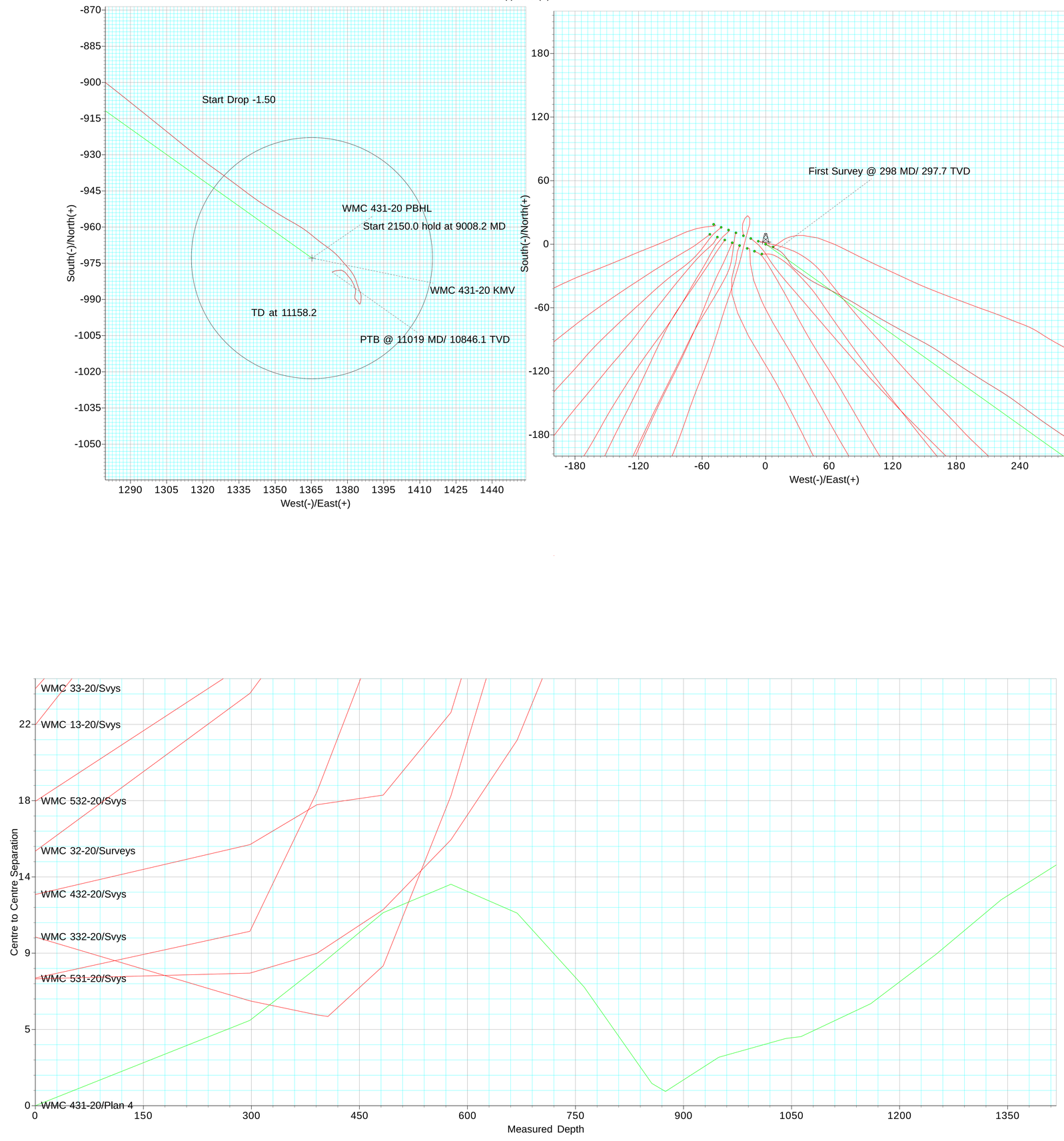
FORMATION TOP DETAILS

TVDPath	MDPath	Formation
4848.0	4941.3	G_SAND
4884.0	4978.1	G_SAND_BASE
6858.0	6996.0	WSTC_LOWER
7318.0	7466.2	MVRD
8838.0	9008.2	KMVGAS
10068.0	10238.2	CMEO
10838.0	11008.2	RLNS
10988.0	11158.2	TD

CASING DETAILS

TVD	MD	Name	Size
1100.0	1110.1	9 5/8"	9-5/8





NATIVE NAVIGATION

DIRECTIONAL DRILLING SPECIALISTS

Directional Survey Certification

Survey Company: Native Navigation **Survey Company Job** 22122684

Well Name WMC 431-20 **A.P.I.#** 05-045-24499 **Operator:** Terra Energy Partners

Latitude: 39.439050 **Longitude:** -107.799425 **County, State:** Garfield County, CO

Legal Description Sec 17, T7S, R93W

Final Report 2/20/2023 **Date of First Survey:** 12/15/2022 **Date of Last Survey:** 12/18/2022

Datum: NAD 83 **Survey MD From:** 298.00 **To:** 10962 FT. **Tool Type:** MWD + HRGM

Bit to Sensor: 57 FT. **Rig (Company & Number):** H&P 329 **RKB Height:** 30.00

Ground Elevation: 8868.00 **Northings:** 1593022.100 **Eastings:** 2350645.600

Surveyor Jeremy Harwood **Depth of Final Projection:** 11019 FT.

The data and calculations for this survey have been checked by me and conform to the calibration standards and operational procedures set forth by Native Navigation. I am authorized and qualified to review the data, calculations and this report, and that the report represents a true and correct Directional Survey of this well, based on the original data corrected to True North and obtained at the well site. Wellbore coordinates are calculated using the minimum curvature method.

Signature	Title	Company	Date
	Well Planner	Native Navigation	2/20/23

Terra Energy Partners, LLP

Garfield County, CO (Nad 83)
WMC 24-17 Pad
WMC 431-20 - Slot WMC 431-20
OH

Survey: Svys

Survey Certification Report

20 February, 2023

NATIVE NAVIGATION
DIRECTIONAL DRILLING SPECIALISTS

Company:	Terra Energy Partners, LLP	**Local Co-ordinate Reference:**	Well WMC 431-20 - Slot WMC 431-20
Project:	Garfield County, CO (Nad 83)	**TVD Reference:**	KB=30' @ 8898.0ft
Site:	WMC 24-17 Pad	**MD Reference:**	KB=30' @ 8898.0ft
Well:	WMC 431-20	**North Reference:**	True
Wellbore:	OH	**Survey Calculation Method:**	Minimum Curvature
Design:	Surveys	**Database:**	NN

Project Garfield County, CO (Nad 83)

Map System:	US State Plane 1983	**System Datum:**	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		

Site WMC 24-17 Pad

Site Position:		**Northing:**	1,593,032.700 usft	**Latitude:**	39.439076
From:	Map	**Easting:**	2,350,593.200 usft	**Longitude:**	-107.799611
Position Uncertainty:	0.0 ft	**Slot Radius:**	13-3/16"	**Grid Convergence:**	-1.45 °

Well WMC 431-20 - Slot WMC 431-20

Well Position	**+N/-S**	0.0 ft	**Northing:**	1,593,022.100 usft	**Latitude:**	39.439050
	+E/-W	0.0 ft	**Easting:**	2,350,645.600 usft	**Longitude:**	-107.799425
Position Uncertainty		0.0 ft	**Wellhead Elevation:**	0.0 ft	**Ground Level:**	8,868.0 ft

Wellbore OH

Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Field Strength (nT)**
	HDGM	12/17/2022	8.87	65.37	51,018

Design Surveys

Audit Notes:

Version:	1.0	**Phase:**	ACTUAL	**Tie On Depth:**	0.0

Vertical Section:	**Depth From (TVD) (ft)**	**+N/-S (ft)**	**+E/-W (ft)**	**Direction (°)**
	0.0	0.0	0.0	125.46

Survey Program **Date** 2/20/2023

From (ft)	**To (ft)**	**Survey (Wellbore)**	**Tool Name**	**Description**
298.0	11,019.0	Svys (OH)	OWSG (REV5) MWD HDGM	OWSG MWD - Standard

Survey

MD (ft)	**Inc (°)**	**Azi (azimuth) (°)**	**TVD (ft)**	**N/S (ft)**	**E/W (ft)**	**Closure Distance (ft)**	**Closure Azimuth (°)**
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00
298.0	4.61	114.85	297.7	-5.0	10.9	12.0	114.85
First Survey @ 298 MD/ 297.7 TVD							
391.0	5.84	139.28	390.3	-10.2	17.4	20.1	120.43
483.0	5.05	152.64	481.9	-17.3	22.3	28.2	127.90
577.0	5.05	125.12	575.5	-23.4	27.6	36.1	130.33
669.0	6.10	127.77	667.1	-28.7	34.7	45.1	129.59
762.0	7.25	121.09	759.5	-34.8	43.7	55.8	128.54
856.0	9.31	114.32	852.5	-41.0	55.7	69.1	126.35
949.0	11.42	117.57	944.0	-48.3	70.7	85.6	124.36
1,042.0	13.44	121.26	1,034.8	-58.2	88.1	105.6	123.45
1,063.0	13.57	121.44	1,055.2	-60.8	92.3	110.5	123.36

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Well:	WMC 431-20	**North Reference:**	True
Wellbore:	OH	**Survey Calculation Method:**	Minimum Curvature
Design:	Surveys	**Database:**	NN

Survey

MD (ft)	Inc (°)	Azi (azimuth) (°)	TVD (ft)	N/S (ft)	E/W (ft)	Closure Distance (ft)	Closure Azimuth (°)
1,160.0	13.53	119.42	1,149.5	-72.3	111.9	133.2	122.86
1,251.0	13.35	118.80	1,238.0	-82.6	130.4	154.3	122.35
1,341.0	13.41	118.01	1,325.6	-92.5	148.7	175.1	121.88
1,431.0	13.53	124.87	1,413.1	-103.4	166.5	196.0	121.83
1,522.0	13.18	123.28	1,501.6	-115.2	183.9	217.0	122.05
1,612.0	13.44	122.05	1,589.2	-126.3	201.4	237.7	122.10
1,703.0	12.96	121.26	1,677.8	-137.2	219.1	258.5	122.07
1,794.0	13.22	126.18	1,766.5	-148.7	236.2	279.1	122.19
1,884.0	13.44	126.62	1,854.0	-161.0	252.9	299.8	122.48
1,974.0	13.49	124.25	1,941.6	-173.1	270.0	320.7	122.68
2,065.0	13.22	123.37	2,030.1	-184.8	287.4	341.7	122.75
2,156.0	12.83	129.00	2,118.8	-196.9	304.0	362.2	122.94
2,246.0	12.52	129.96	2,206.6	-209.5	319.2	381.8	123.27
2,337.0	12.92	130.06	2,295.3	-222.4	334.6	401.7	123.61
2,427.0	12.88	128.03	2,383.1	-235.0	350.2	421.7	123.87
2,518.0	12.30	126.72	2,471.9	-247.1	365.9	441.5	124.03
2,608.0	12.26	125.40	2,559.8	-258.3	381.4	460.6	124.11
2,699.0	11.78	124.87	2,648.8	-269.2	396.9	479.6	124.15
2,789.0	11.78	123.38	2,736.9	-279.5	412.1	498.0	124.15
2,880.0	11.69	123.90	2,826.0	-289.8	427.5	516.5	124.13
2,970.0	10.81	123.82	2,914.3	-299.6	442.1	534.0	124.12
3,060.0	12.17	131.64	3,002.5	-310.6	456.2	551.9	124.25
3,151.0	12.22	132.60	3,091.4	-323.5	470.4	570.9	124.51
3,242.0	12.39	131.11	3,180.4	-336.4	484.9	590.2	124.75
3,332.0	11.95	131.90	3,268.3	-349.0	499.1	609.0	124.96
3,422.0	11.78	132.43	3,356.4	-361.4	512.8	627.4	125.17
3,513.0	12.96	130.93	3,445.3	-374.4	527.4	646.7	125.37
3,604.0	12.88	130.85	3,534.0	-387.7	542.8	667.0	125.54
3,694.0	12.92	131.73	3,621.7	-400.9	557.9	687.0	125.70
3,784.0	12.66	131.11	3,709.5	-414.1	572.8	706.8	125.87
3,875.0	12.26	130.41	3,798.3	-426.9	587.7	726.4	126.00
3,966.0	12.09	129.70	3,887.3	-439.3	602.4	745.5	126.10
4,056.0	12.09	129.18	3,975.3	-451.3	616.9	764.3	126.18
4,147.0	11.78	128.30	4,064.3	-463.0	631.6	783.1	126.25
4,237.0	11.73	126.36	4,152.4	-474.2	646.2	801.5	126.27
4,328.0	11.38	127.24	4,241.6	-485.1	660.8	819.7	126.28
4,418.0	11.29	125.84	4,329.8	-495.6	675.0	837.4	126.29
4,509.0	10.72	126.63	4,419.2	-505.9	689.0	854.8	126.29
4,599.0	12.66	124.17	4,507.3	-516.4	703.9	873.0	126.27
4,690.0	11.87	124.34	4,596.2	-527.3	719.8	892.3	126.22
4,780.0	12.13	124.78	4,684.3	-537.9	735.3	911.0	126.19
4,871.0	11.91	125.13	4,773.3	-548.8	750.8	930.0	126.16
4,961.0	11.42	123.11	4,861.4	-559.0	765.8	948.1	126.12
5,052.0	11.20	121.96	4,950.6	-568.6	780.9	965.9	126.06

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Well:	WMC 431-20	**North Reference:**	True
Wellbore:	OH	**Survey Calculation Method:**	Minimum Curvature
Design:	Surveys	**Database:**	NN

Survey

MD (ft)	Inc (°)	Azi (azimuth) (°)	TVD (ft)	N/S (ft)	E/W (ft)	Closure Distance (ft)	Closure Azimuth (°)
5,142.0	13.09	123.02	5,038.6	-578.7	796.9	984.8	125.99
5,233.0	13.05	122.84	5,127.3	-589.9	814.1	1,005.4	125.93
5,323.0	12.30	123.55	5,215.1	-600.7	830.7	1,025.1	125.88
5,414.0	12.08	122.14	5,304.0	-611.2	846.8	1,044.3	125.82
5,504.0	11.90	123.20	5,392.1	-621.3	862.5	1,063.0	125.76
5,595.0	11.64	123.37	5,481.1	-631.4	878.0	1,081.5	125.72
5,685.0	11.25	122.93	5,569.4	-641.2	893.0	1,099.4	125.68
5,776.0	11.03	123.46	5,658.6	-650.8	907.7	1,116.9	125.64
5,867.0	12.12	124.07	5,747.8	-661.0	922.9	1,135.2	125.61
5,957.0	11.99	122.67	5,835.8	-671.3	938.6	1,154.0	125.57
6,047.0	11.03	123.20	5,924.0	-681.1	953.7	1,171.9	125.53
6,138.0	12.34	123.46	6,013.1	-691.2	969.1	1,190.3	125.50
6,228.0	12.08	125.22	6,101.1	-701.9	984.8	1,209.3	125.48
6,319.0	11.51	126.01	6,190.1	-712.8	999.9	1,227.9	125.48
6,410.0	11.38	127.68	6,279.3	-723.6	1,014.3	1,246.0	125.50
6,500.0	11.33	127.94	6,367.6	-734.5	1,028.3	1,263.7	125.54
6,591.0	10.54	128.47	6,456.9	-745.1	1,041.9	1,280.9	125.57
6,681.0	11.51	122.23	6,545.3	-755.1	1,056.0	1,298.1	125.57
6,772.0	11.68	119.24	6,634.4	-764.4	1,071.7	1,316.3	125.50
6,862.0	11.38	120.21	6,722.6	-773.3	1,087.3	1,334.2	125.42
6,953.0	11.16	120.30	6,811.8	-782.3	1,102.7	1,352.0	125.35
7,044.0	11.25	122.06	6,901.1	-791.4	1,117.8	1,369.6	125.30
7,134.0	10.85	122.67	6,989.4	-800.7	1,132.4	1,386.8	125.26
7,225.0	12.61	123.99	7,078.5	-810.8	1,147.8	1,405.3	125.24
7,315.0	12.83	123.90	7,166.3	-821.9	1,164.2	1,425.1	125.22
7,406.0	11.78	122.50	7,255.2	-832.5	1,180.5	1,444.5	125.19
7,496.0	11.65	120.48	7,343.4	-842.1	1,196.0	1,462.7	125.15
7,587.0	11.12	121.35	7,432.6	-851.3	1,211.5	1,480.7	125.10
7,677.0	11.03	119.60	7,520.9	-860.1	1,226.4	1,497.9	125.04
7,768.0	12.48	127.33	7,610.0	-870.3	1,241.7	1,516.4	125.03
7,858.0	12.44	129.35	7,697.9	-882.4	1,257.0	1,535.8	125.07
7,949.0	11.56	127.07	7,786.9	-894.1	1,271.8	1,554.6	125.11
8,039.0	10.20	128.56	7,875.3	-904.5	1,285.3	1,571.6	125.14
8,130.0	11.29	128.83	7,964.7	-915.1	1,298.5	1,588.5	125.17
8,220.0	11.03	129.09	8,053.0	-926.1	1,312.0	1,605.9	125.21
8,310.0	9.66	125.39	8,141.5	-935.9	1,324.9	1,622.1	125.24
8,401.0	8.48	127.41	8,231.4	-944.4	1,336.4	1,636.4	125.25
8,491.0	8.04	122.93	8,320.4	-951.8	1,347.0	1,649.3	125.25
8,582.0	6.89	118.98	8,410.7	-957.9	1,357.1	1,661.1	125.22
8,672.0	5.44	129.96	8,500.1	-963.3	1,365.1	1,670.7	125.21
8,763.0	3.16	124.43	8,590.9	-967.5	1,370.5	1,677.5	125.22
8,853.0	2.94	130.84	8,680.7	-970.4	1,374.3	1,682.3	125.23
8,943.0	2.81	140.42	8,770.6	-973.6	1,377.4	1,686.7	125.25
9,034.0	2.37	137.08	8,861.5	-976.7	1,380.1	1,690.7	125.29
9,124.0	2.41	149.12	8,951.5	-979.7	1,382.4	1,694.3	125.32

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Site:	WMC 24-17 Pad	**MD Reference:**	KB=30' @ 8898.0ft
Well:	WMC 431-20	**North Reference:**	True
Wellbore:	OH	**Survey Calculation Method:**	Minimum Curvature
Design:	Surveys	**Database:**	NN

Survey

MD (ft)	Inc (°)	Azi (azimuth) (°)	TVD (ft)	N/S (ft)	E/W (ft)	Closure Distance (ft)	Closure Azimuth (°)
9,215.0	1.84	164.33	9,042.4	-982.7	1,383.7	1,697.2	125.38
9,305.0	1.31	158.97	9,132.4	-985.1	1,384.5	1,699.2	125.43
9,396.0	1.31	157.56	9,223.3	-987.0	1,385.3	1,700.9	125.47
9,486.0	1.10	179.63	9,313.3	-988.8	1,385.7	1,702.3	125.51
9,577.0	1.27	185.25	9,404.3	-990.7	1,385.6	1,703.3	125.56
9,667.0	0.44	230.87	9,494.3	-991.9	1,385.2	1,703.7	125.60
9,758.0	0.40	337.13	9,585.3	-991.8	1,384.8	1,703.4	125.61
9,848.0	0.75	327.46	9,675.3	-991.0	1,384.4	1,702.5	125.60
9,939.0	0.62	307.07	9,766.3	-990.2	1,383.7	1,701.5	125.59
10,029.0	0.48	333.52	9,856.3	-989.6	1,383.1	1,700.7	125.58
10,120.0	0.92	10.00	9,947.3	-988.5	1,383.1	1,700.0	125.56
10,210.0	0.75	13.78	10,037.3	-987.3	1,383.3	1,699.5	125.51
10,300.0	0.66	352.59	10,127.3	-986.2	1,383.4	1,698.9	125.48
10,391.0	0.87	335.80	10,218.2	-985.0	1,383.1	1,698.0	125.46
10,481.0	1.23	339.32	10,308.2	-983.5	1,382.4	1,696.6	125.43
10,572.0	1.09	323.23	10,399.2	-981.9	1,381.6	1,694.9	125.40
10,662.0	1.27	317.61	10,489.2	-980.5	1,380.4	1,693.2	125.39
10,753.0	1.53	325.17	10,580.2	-978.7	1,379.0	1,691.0	125.36
10,843.0	1.09	266.02	10,670.1	-977.8	1,377.5	1,689.2	125.37
10,934.0	1.45	261.36	10,761.1	-978.0	1,375.5	1,687.7	125.41
10,962.0	1.18	249.41	10,789.1	-978.2	1,374.8	1,687.3	125.43
11,019.0	1.18	249.41	10,846.1	-978.6	1,373.8	1,686.7	125.46

PTB @ 11019 MD/ 10846.1 TVD

Survey Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	Local Coordinates +E/-W (ft)	Comment
298.0	297.7	-5.0	10.9	First Survey @ 298 MD/ 297.7 TVD
11,019.0	10,846.1	-978.6	1,373.8	PTB @ 11019 MD/ 10846.1 TVD

Checked By: _____ Approved By: _____ Date: _____