

# HALLIBURTON

6360 EAST YELLOWSTONE HWY • EVANSVILLE, WY 82636

TEL: 307-472-5757 • FAX: 307-232-2097

## Certified Survey Sheet

Customer: **Extraction Oil & Gas**

Well: **NORTHWEST A S20-25-12N – Original Wellbore**

API: 05-014-20786

Legal: Sec. 09-T01S-R68W

County: Broomfield

State: Colorado

RKB (Patterson 901): 29', 5,343.0' MSL

Tie-On (Atlas Surveys): 1,550' MD

First Sperry MWD Survey: 1,736' MD

Last Sperry MWD Survey: 21,576' MD

Straight Line Projection to TD: 21,610' MD

I certify that the attached survey is true and correct to the best of my knowledge.



01-10-19

Kansa Becker  
Well Design Senior Technical Professional

# HALLIBURTON SPERRY DRILLING SERVICES

## CERTIFIED SURVEY WORK SHEET

<b>OPERATOR:</b>	Extraction Oil & Gas
<b>WELL:</b>	NorthWest A S20-25-12N
<b>FIELD:</b>	Wattenberg
<b>RIG:</b>	Patterson UTI rig #901
<b>LEGALS:</b>	Sec. 9-T1S-R68W
<b>COUNTY:</b>	Broomfield
<b>STATE:</b>	Colorado
<b>CAL. METHOD:</b>	Minimum Curvature
<b>MAG. DECL. APPLIED:</b>	8.24° True
<b>VERTICAL SEC. DIR. :</b>	194.19°

<b>SSDS Job Number :</b>	CA-MJ-906084549
<b>Start Date of Job :</b>	12/31/2019
<b>End Date of Job :</b>	1/3/2020
<b>Lead Directional Driller:</b>	Justin Lee Groom
	Roland Hall
<b>Other SDS DD's :</b>	
<b>SDS MWD Engineers :</b>	Sean Maingot
	Scott Browning
	Pedro Herrera

	Main Hole =====>	1st Side Track =====>	2nd Side Track =====>	3rd Side Track =====>	4th Side Track =====>
First Survey Depth	1550.00	Tie On	Tie On	Tie On	Tie On
Last Survey Depth		MWD			
		MWD			
KOP Depth/Sidetrack MD		KOP	KOP-ST1	KOP-ST2	KOP-ST3
First Survey Depth	1736.00	MWD	MWD	MWD	MWD
Last Survey Depth	21576.00	MWD	MWD	MWD	MWD
Bit Extrapolation to TD	21610.00	T.D.	T.D.	T.D.	T.D.

The following Halliburton Sperry Drilling Services personnel listed below, do certify the above survey information to be accurate :

Print Name : Justin Lee Groom      Print Name :      Print Name :

Sign Name : *Justin Lee Groom*      Sign Name :      Sign Name :

Print Name :      Print Name :      Print Name :

Sign Name :      Sign Name :      Sign Name :

### Examples of Survey Types:

TieOn	Tie On to Surface Casing (Assumed Vertical), Tie On to existing MWD Survey (prior drilled hole)
MWD	Sperry Drilling Services (SDS) Measurement While Drilling (MWD) Survey's
ESS	Sperry Drilling Services (SDS) Electronic Survey System (ESS) Survey's
Gyro	Gyro Survey's ; Provided by third party vendor, or by Sperry Drilling Services (SDS)
SS	Single Shot (SS) Survey's ; Provided by Sperry Drilling Services (SDS) or third party vendor.

Job# 906084549

Patterson 901

# Extraction Oil & Gas

Broomfield County, CO Sec. 09-T01S-R68W (NORTHWEST A S20-25 Pad)

API# 05-014-20786

**NORTHWEST A S20-25-12N**

SHL: 1281' FNL 849' FWL

OWB\_20786

Design: Final Surveys

## Sperry Drilling Services

### Combo Report

16 January, 2020

Well Coordinates: 39.983180  
-105.012792

North American Datum 1983  
Colorado Northern Zone  
1,237,094.79 N  
3,136,526.05 E

Ground Level: 5,314.00 usft

Geodetic Scale Factor Applied

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

**North Reference:**

Unit System:

Geodetic Scale Factor Applied

Version: 5000.15 Build: 91E

Report Version: Midcon Combo v1.15

Centered on Well NORTHWEST A S20-25-12N

KB = 29' @ 5343.00usft (Patterson 901)

N

**True**

Dec-Deg - API - US Survey Feet - Cust (6 dec)

**HALLIBURTON**

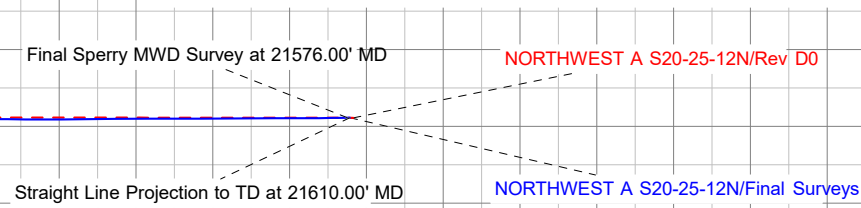
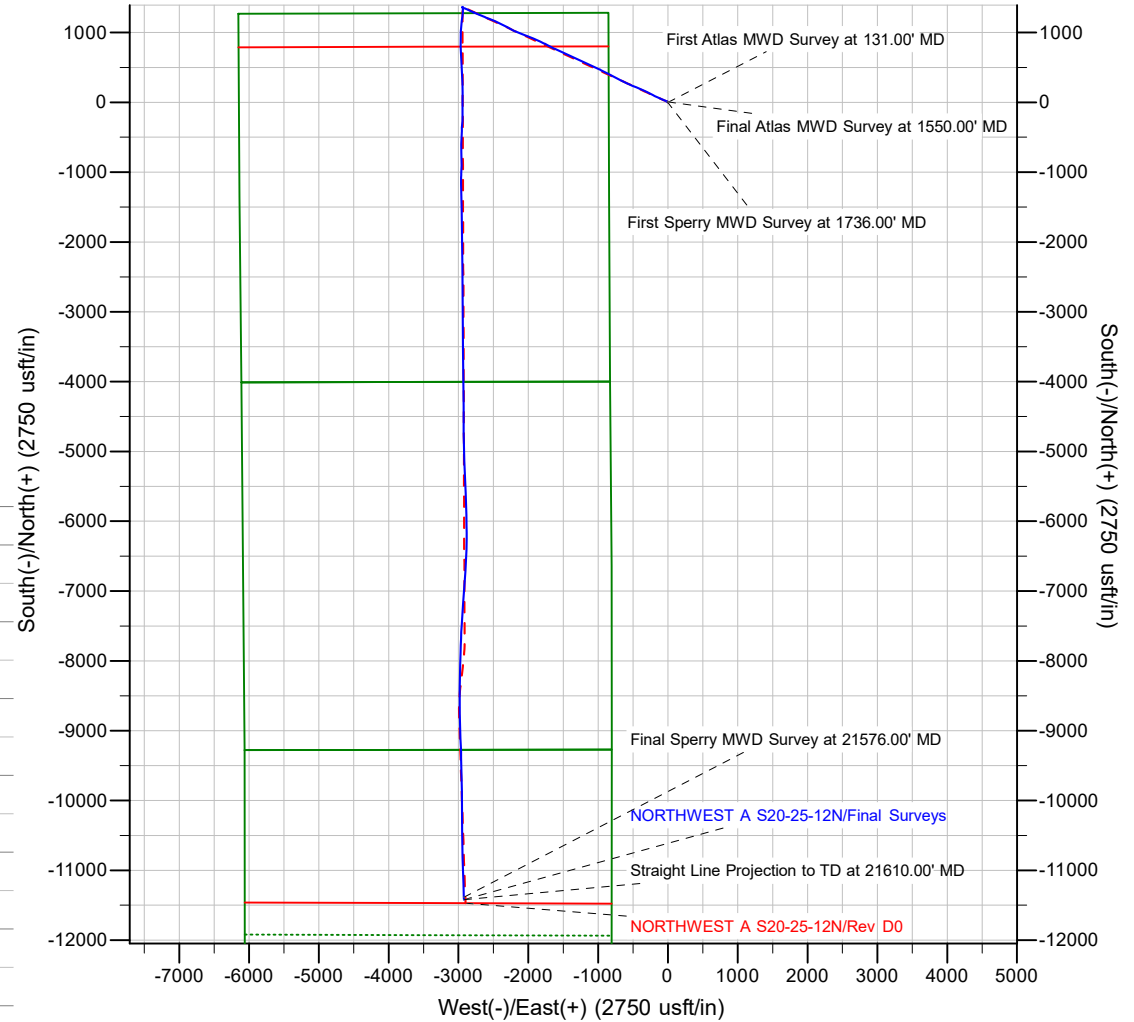
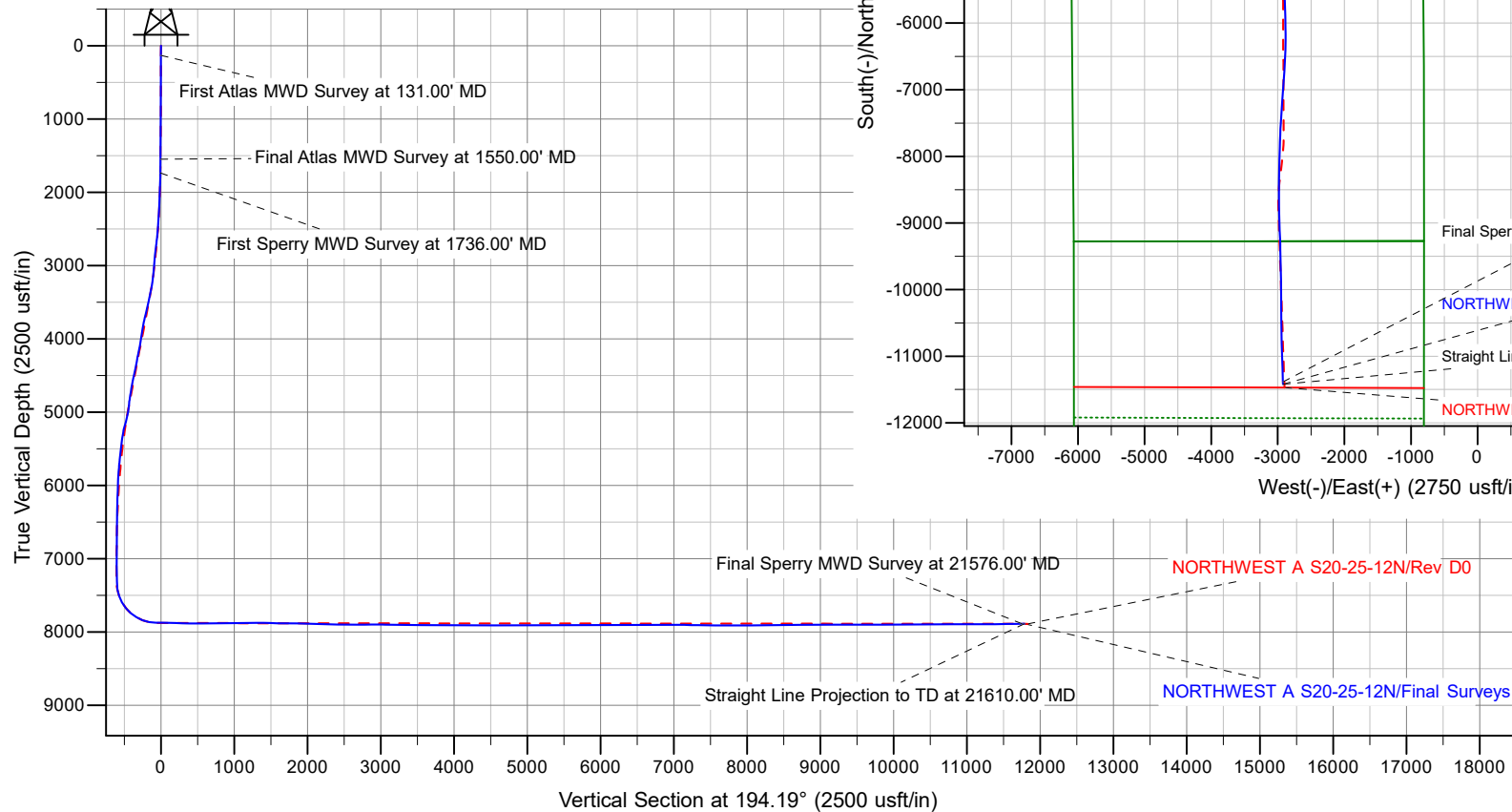
Project: Broomfield County, CO  
Site: Sec. 09-T01S-R68W (NORTHWEST A S20-25 Pad)  
Well: NORTHWEST A S20-25-12N  
Wellbore: OWB\_20786  
Design: Final Surveys

# Extraction Oil & Gas Patterson 901

**HALLIBURTON**  
Sperry Drilling

## LEGEND

- NORTHWEST A S20-25-12N, OWB\_20786, Rev D0 V0
- Final Surveys



## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured Depth (usft)	Inclination (°)	True Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100usft)	Vertical Section (usft)	Toolface Angle (°)	Comments
				Northing (usft)	Easting (usft)	Northing (usft)	Easting (usft)				
0.00	0.00	0.00	0.00	0.00 N	0.00 E	1,237,094.79	3,136,526.05	0.00	0.00	0.00	
131.00	0.27	100.92	131.00	0.06 S	0.30 E	1,237,094.74	3,136,526.35	0.21	-0.02	100.92	First Atlas MWD Survey at 131.00' MD
223.00	0.40	87.44	223.00	0.09 S	0.84 E	1,237,094.71	3,136,526.89	0.16	-0.12	-38.08	
314.00	0.49	93.04	314.00	0.09 S	1.54 E	1,237,094.71	3,136,527.59	0.11	-0.29	28.61	
403.00	0.35	92.64	402.99	0.12 S	2.19 E	1,237,094.68	3,136,528.24	0.16	-0.42	-179.00	
492.00	0.53	93.48	491.99	0.16 S	2.88 E	1,237,094.65	3,136,528.93	0.20	-0.55	2.47	
582.00	0.40	95.11	581.99	0.22 S	3.61 E	1,237,094.60	3,136,529.65	0.15	-0.68	175.00	
672.00	0.57	82.02	671.98	0.18 S	4.36 E	1,237,094.64	3,136,530.41	0.22	-0.89	-39.75	
761.00	0.80	94.93	760.98	0.17 S	5.42 E	1,237,094.65	3,136,531.47	0.31	-1.16	40.43	
851.00	0.35	16.89	850.97	0.04 N	6.12 E	1,237,094.86	3,136,532.17	0.89	-1.54	-154.79	
940.00	0.44	347.66	939.97	0.63 N	6.13 E	1,237,095.46	3,136,532.18	0.24	-2.11	-81.01	
1,029.00	0.40	336.60	1,028.97	1.25 N	5.93 E	1,237,096.07	3,136,531.98	0.10	-2.67	-121.72	
1,118.00	0.27	333.42	1,117.97	1.72 N	5.72 E	1,237,096.55	3,136,531.76	0.15	-3.07	-173.45	
1,208.00	0.44	347.00	1,207.97	2.25 N	5.54 E	1,237,097.07	3,136,531.58	0.21	-3.54	33.23	
1,297.00	0.53	347.83	1,296.96	2.98 N	5.38 E	1,237,097.81	3,136,531.41	0.10	-4.21	4.88	
1,386.00	0.66	346.25	1,385.96	3.88 N	5.17 E	1,237,098.70	3,136,531.20	0.15	-5.03	-7.98	
1,475.00	2.03	292.31	1,474.93	4.98 N	3.59 E	1,237,099.79	3,136,529.61	1.94	-5.71	-71.94	
1,550.00	3.67	290.94	1,549.84	6.34 N	0.12 E	1,237,101.13	3,136,526.13	2.19	-6.18	-3.06	Final Atlas MWD Survey at 1550.00' MD
1,736.00	4.16	286.57	1,735.40	10.39 N	11.91 W	1,237,105.12	3,136,514.09	0.31	-7.16	-33.53	First Sperry MWD Survey at 1736.00' MD
1,832.00	7.19	303.84	1,830.93	14.73 N	20.24 W	1,237,109.41	3,136,505.73	3.59	-9.32	38.19	
1,927.00	9.43	294.60	1,924.93	21.29 N	32.25 W	1,237,115.90	3,136,493.68	2.74	-12.73	-35.43	
2,046.00	12.30	291.60	2,041.79	30.01 N	52.90 W	1,237,124.51	3,136,472.98	2.46	-16.13	-12.62	
2,142.00	15.95	293.07	2,134.87	38.95 N	74.56 W	1,237,133.33	3,136,451.28	3.82	-19.48	6.33	
2,236.00	16.68	292.92	2,225.08	49.26 N	98.86 W	1,237,143.51	3,136,426.92	0.78	-23.53	-3.38	
2,331.00	19.19	295.45	2,315.46	61.28 N	125.52 W	1,237,155.38	3,136,400.19	2.77	-28.64	18.45	
2,427.00	21.58	295.85	2,405.44	75.76 N	155.66 W	1,237,169.70	3,136,369.98	2.49	-35.30	3.52	
2,521.00	22.00	296.34	2,492.72	91.11 N	187.00 W	1,237,184.87	3,136,338.56	0.49	-42.50	23.64	
2,616.00	24.13	295.81	2,580.13	107.46 N	220.43 W	1,237,201.04	3,136,305.04	2.25	-50.15	-5.81	
2,712.00	25.31	298.44	2,667.33	125.78 N	256.14 W	1,237,219.16	3,136,269.23	1.68	-59.16	44.19	
2,807.00	27.76	295.81	2,752.32	145.09 N	293.92 W	1,237,238.26	3,136,231.34	2.86	-68.61	-26.80	
2,900.00	28.43	295.30	2,834.36	163.98 N	333.43 W	1,237,256.93	3,136,191.73	0.77	-77.24	-19.95	
2,994.00	29.51	294.12	2,916.60	183.00 N	374.80 W	1,237,275.73	3,136,150.27	1.30	-85.55	-28.41	
3,090.00	31.88	292.49	2,999.14	202.37 N	419.80 W	1,237,294.84	3,136,105.15	2.62	-93.29	-20.05	
3,184.00	34.44	290.49	3,077.83	221.17 N	467.65 W	1,237,313.38	3,136,057.21	2.96	-99.79	-23.98	
3,278.00	36.78	293.05	3,154.25	241.50 N	518.45 W	1,237,333.43	3,136,006.30	2.95	-107.04	33.54	
3,373.00	39.05	294.62	3,229.20	265.10 N	571.83 W	1,237,356.74	3,135,952.79	2.60	-116.84	23.65	

## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured		True	Vertical	Local Coordinates		Map Coordinates		Dogleg	Vertical	Toolface	Comments
Depth	Inclination	Azimuth	Depth	Northing	Easting	Northing	Easting	Rate	Section	Angle	
(usft)	(°)	(°)	(usft)	(usft)	(usft)	(usft)	(usft)	(°/100usft)	(usft)	(°)	
3,468.00	42.42	297.39	3,301.18	292.32 N	627.51 W	1,237,383.65	3,135,896.96	4.02	-129.58	29.27	
3,563.00	44.58	296.98	3,370.08	322.19 N	685.68 W	1,237,413.20	3,135,838.63	2.29	-144.28	-7.59	
3,658.00	41.00	296.03	3,439.79	351.00 N	743.41 W	1,237,441.69	3,135,780.75	3.83	-158.06	-170.13	
3,753.00	44.97	297.11	3,509.27	379.98 N	801.32 W	1,237,470.36	3,135,722.68	4.25	-171.97	10.91	
3,848.00	47.23	297.53	3,575.14	411.40 N	862.13 W	1,237,501.44	3,135,661.70	2.40	-187.52	7.77	
3,944.00	44.58	297.49	3,641.94	443.25 N	923.27 W	1,237,532.95	3,135,600.38	2.76	-203.41	-179.39	
4,039.00	49.36	296.08	3,706.74	474.50 N	985.26 W	1,237,563.86	3,135,538.23	5.15	-218.52	-12.65	
4,134.00	46.71	295.70	3,770.26	505.35 N	1,048.80 W	1,237,594.35	3,135,474.52	2.81	-232.84	-174.04	
4,230.00	47.17	293.80	3,835.81	534.71 N	1,112.49 W	1,237,623.36	3,135,410.67	1.52	-245.69	-72.32	
4,325.00	43.02	293.17	3,902.86	561.53 N	1,174.19 W	1,237,649.84	3,135,348.83	4.39	-256.57	-174.08	
4,421.00	45.21	293.67	3,971.78	588.09 N	1,235.50 W	1,237,676.07	3,135,287.37	2.31	-267.30	9.21	
4,516.00	41.89	293.53	4,040.62	614.29 N	1,295.47 W	1,237,701.94	3,135,227.26	3.50	-278.00	-178.39	
4,611.00	42.34	296.92	4,111.10	641.44 N	1,353.08 W	1,237,728.77	3,135,169.50	2.44	-290.20	80.06	
4,707.00	45.92	296.92	4,180.00	671.70 N	1,412.67 W	1,237,758.70	3,135,109.75	3.73	-304.93	0.00	
4,802.00	47.08	293.86	4,245.40	701.23 N	1,474.92 W	1,237,787.88	3,135,047.34	2.64	-318.29	-63.47	
4,897.00	46.99	294.57	4,310.15	729.74 N	1,538.32 W	1,237,816.05	3,134,983.79	0.56	-330.40	100.07	
4,992.00	43.29	294.02	4,377.15	757.45 N	1,599.68 W	1,237,843.42	3,134,922.28	3.92	-342.22	-174.18	
5,087.00	44.59	296.82	4,445.56	785.76 N	1,659.20 W	1,237,871.40	3,134,862.61	2.46	-355.08	57.23	
5,182.00	46.51	297.37	4,512.08	816.65 N	1,719.57 W	1,237,901.95	3,134,802.08	2.06	-370.23	11.75	
5,276.00	48.02	295.48	4,575.87	847.36 N	1,781.40 W	1,237,932.32	3,134,740.08	2.18	-384.84	-43.24	
5,371.00	44.43	294.65	4,641.59	876.43 N	1,843.51 W	1,237,961.05	3,134,677.81	3.83	-397.80	-170.81	
5,465.00	45.34	292.43	4,708.19	902.91 N	1,904.32 W	1,237,987.19	3,134,616.85	1.93	-408.57	-60.64	
5,560.00	47.46	292.29	4,773.70	929.08 N	1,967.95 W	1,238,013.01	3,134,553.09	2.23	-418.34	-2.79	
5,655.00	47.63	292.84	4,837.83	955.97 N	2,032.67 W	1,238,039.55	3,134,488.22	0.46	-428.55	67.46	
5,750.00	43.44	289.26	4,904.37	980.38 N	2,095.88 W	1,238,063.61	3,134,424.88	5.16	-436.72	-149.87	
5,845.00	43.57	292.27	4,973.28	1,003.57 N	2,157.02 W	1,238,086.46	3,134,363.62	2.19	-444.21	87.50	
5,939.00	44.99	296.65	5,040.59	1,030.75 N	2,216.71 W	1,238,113.32	3,134,303.78	3.59	-455.94	66.67	
6,034.00	46.76	298.71	5,106.74	1,062.44 N	2,277.08 W	1,238,144.68	3,134,243.23	2.43	-471.86	40.60	
6,129.00	49.02	298.97	5,170.43	1,096.44 N	2,338.81 W	1,238,178.33	3,134,181.32	2.39	-489.69	4.97	
6,224.00	50.50	295.15	5,231.81	1,129.39 N	2,403.38 W	1,238,210.93	3,134,116.57	3.44	-505.81	-64.33	
6,320.00	48.45	293.59	5,294.19	1,159.51 N	2,469.84 W	1,238,240.68	3,134,049.96	2.47	-518.72	-150.46	
6,414.00	46.00	291.87	5,358.03	1,186.19 N	2,533.46 W	1,238,267.01	3,133,986.19	2.93	-528.99	-153.32	
6,509.00	42.53	290.56	5,426.05	1,210.20 N	2,595.25 W	1,238,290.68	3,133,924.27	3.78	-537.12	-165.70	
6,604.00	39.75	293.73	5,497.60	1,233.71 N	2,653.14 W	1,238,313.87	3,133,866.25	3.66	-545.72	144.31	
6,699.00	36.04	292.60	5,572.55	1,256.68 N	2,706.77 W	1,238,336.54	3,133,812.51	3.97	-554.85	-169.85	
6,794.00	33.66	292.27	5,650.51	1,277.40 N	2,756.94 W	1,238,356.98	3,133,762.22	2.51	-562.64	-175.60	
6,889.00	28.24	293.78	5,731.95	1,296.45 N	2,801.90 W	1,238,375.79	3,133,717.15	5.76	-570.09	172.49	



## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured Depth (usft)	Inclination (°)	True Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100usft)	Vertical Section (usft)	Toolface Angle (°)	Comments
6,984.00	22.08	296.52	5,817.90	1,313.51 N	2,838.48 W	1,238,392.64	3,133,680.48	6.60	-577.65	170.53	
7,079.00	17.52	293.94	5,907.26	1,327.29 N	2,867.55 W	1,238,406.26	3,133,651.35	4.89	-583.89	-170.36	
7,175.00	14.03	291.81	5,999.63	1,337.48 N	2,891.56 W	1,238,416.32	3,133,627.27	3.68	-587.88	-171.60	
7,269.00	12.19	292.41	6,091.18	1,345.50 N	2,911.32 W	1,238,424.23	3,133,607.48	1.96	-590.81	176.06	
7,365.00	9.40	288.96	6,185.47	1,351.91 N	2,928.11 W	1,238,430.55	3,133,590.65	2.98	-592.92	-168.65	
7,460.00	5.01	305.39	6,279.71	1,356.83 N	2,938.83 W	1,238,435.42	3,133,579.90	5.06	-595.06	162.85	
7,555.00	2.43	321.54	6,374.50	1,360.81 N	2,943.47 W	1,238,439.37	3,133,575.24	2.90	-597.79	165.82	
7,650.00	0.67	13.52	6,469.47	1,362.93 N	2,944.59 W	1,238,441.48	3,133,574.11	2.19	-599.56	165.33	
7,745.00	1.05	10.21	6,564.46	1,364.33 N	2,944.31 W	1,238,442.88	3,133,574.39	0.40	-600.99	-9.11	
7,840.00	1.13	354.00	6,659.44	1,366.12 N	2,944.25 W	1,238,444.67	3,133,574.43	0.33	-602.73	-83.65	
7,935.00	0.90	305.67	6,754.43	1,367.48 N	2,944.95 W	1,238,446.03	3,133,573.72	0.90	-603.89	-128.33	
8,126.00	0.29	178.54	6,945.42	1,367.88 N	2,946.16 W	1,238,446.42	3,133,572.51	0.58	-603.97	-167.86	
8,221.00	0.31	142.09	7,040.42	1,367.43 N	2,946.00 W	1,238,445.97	3,133,572.68	0.20	-603.58	-102.44	
8,316.00	0.66	128.03	7,135.41	1,366.89 N	2,945.41 W	1,238,445.44	3,133,573.27	0.39	-603.20	-25.90	
8,410.00	0.76	117.39	7,229.41	1,366.27 N	2,944.43 W	1,238,444.82	3,133,574.26	0.18	-602.84	-58.22	
8,505.00	0.78	111.80	7,324.40	1,365.74 N	2,943.27 W	1,238,444.30	3,133,575.42	0.08	-602.61	-77.90	
8,600.00	11.70	173.44	7,418.72	1,355.90 N	2,941.56 W	1,238,434.47	3,133,577.18	11.95	-593.49	65.06	
8,695.00	20.08	173.75	7,510.00	1,330.07 N	2,938.68 W	1,238,408.66	3,133,580.20	8.82	-569.16	0.73	
8,791.00	28.74	182.57	7,597.37	1,290.55 N	2,937.92 W	1,238,369.14	3,133,581.18	9.76	-531.02	26.91	
8,886.00	39.85	186.87	7,675.74	1,237.34 N	2,942.60 W	1,238,315.90	3,133,576.79	11.96	-478.29	14.11	
8,981.00	50.31	187.05	7,742.73	1,170.66 N	2,950.75 W	1,238,249.18	3,133,569.01	11.01	-411.64	0.76	
9,076.00	59.14	185.84	7,797.54	1,093.66 N	2,959.40 W	1,238,172.15	3,133,560.78	9.35	-334.88	-6.74	
9,171.00	67.55	184.27	7,840.12	1,009.17 N	2,966.83 W	1,238,087.61	3,133,553.81	8.97	-251.14	-9.83	
9,266.00	80.85	180.52	7,865.94	918.06 N	2,970.54 W	1,237,996.48	3,133,550.60	14.50	-161.90	-15.73	
9,361.00	91.04	178.49	7,872.65	823.43 N	2,969.72 W	1,237,901.86	3,133,551.95	10.94	-70.36	-11.33	
9,456.00	88.79	177.15	7,872.79	728.50 N	2,966.10 W	1,237,806.97	3,133,556.08	2.76	20.78	-149.22	
9,551.00	87.88	176.83	7,875.55	633.68 N	2,961.12 W	1,237,712.17	3,133,561.59	1.02	111.50	-160.64	
9,646.00	88.32	177.96	7,878.70	538.83 N	2,956.80 W	1,237,617.35	3,133,566.43	1.28	202.39	68.73	
9,742.00	88.69	177.10	7,881.20	442.95 N	2,952.67 W	1,237,521.50	3,133,571.09	0.97	294.33	-66.73	
9,836.00	89.19	176.19	7,882.94	349.13 N	2,947.17 W	1,237,427.71	3,133,577.10	1.10	383.94	-61.22	
9,931.00	90.17	179.88	7,883.47	254.20 N	2,943.91 W	1,237,332.81	3,133,580.88	4.02	475.17	75.14	
10,026.00	90.97	178.78	7,882.53	159.22 N	2,942.80 W	1,237,237.83	3,133,582.52	1.43	566.99	-53.97	
10,122.00	89.63	181.43	7,882.03	63.23 N	2,942.97 W	1,237,141.85	3,133,582.87	3.09	660.09	116.81	
10,217.00	90.13	180.34	7,882.22	31.76 S	2,944.44 W	1,237,046.86	3,133,581.92	1.26	752.54	-65.36	
10,312.00	90.64	179.80	7,881.59	126.75 S	2,944.56 W	1,236,951.87	3,133,582.33	0.78	844.67	-46.63	
10,406.00	91.14	179.59	7,880.13	220.74 S	2,944.06 W	1,236,857.89	3,133,583.34	0.58	935.66	-22.78	
10,501.00	90.20	182.87	7,879.01	315.70 S	2,946.10 W	1,236,762.92	3,133,581.83	3.59	1,028.23	105.97	

## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured Depth (usft)	Inclination (°)	True Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100usft)	Vertical Section (usft)	Toolface Angle (°)	Comments
10,596.00	90.94	183.24	7,878.07	410.56 S	2,951.16 W	1,236,668.04	3,133,577.29	0.87	1,121.43	26.56	
10,691.00	89.80	182.31	7,877.46	505.44 S	2,955.76 W	1,236,573.13	3,133,573.21	1.55	1,214.55	-140.79	
10,787.00	91.18	181.39	7,876.64	601.39 S	2,958.86 W	1,236,477.18	3,133,570.64	1.73	1,308.32	-33.69	
10,882.00	88.62	178.76	7,876.80	696.37 S	2,958.98 W	1,236,382.20	3,133,571.03	3.86	1,400.44	-134.22	
10,976.00	88.46	179.81	7,879.20	790.33 S	2,957.81 W	1,236,288.25	3,133,572.72	1.13	1,491.25	98.68	
11,071.00	89.03	180.36	7,881.28	885.31 S	2,957.95 W	1,236,193.28	3,133,573.10	0.83	1,583.36	43.98	
11,167.00	90.24	180.86	7,881.89	981.30 S	2,958.97 W	1,236,097.29	3,133,572.61	1.36	1,676.67	22.45	
11,261.00	88.52	182.73	7,882.91	1,075.24 S	2,961.92 W	1,236,003.33	3,133,570.18	2.70	1,768.47	132.62	
11,356.00	89.46	179.04	7,884.58	1,170.19 S	2,963.38 W	1,235,908.37	3,133,569.24	4.01	1,860.89	-75.74	
11,452.00	88.32	178.34	7,886.44	1,266.15 S	2,961.19 W	1,235,812.43	3,133,571.96	1.39	1,953.38	-148.46	
11,547.00	89.80	178.79	7,888.00	1,361.10 S	2,958.81 W	1,235,717.50	3,133,574.86	1.63	2,044.85	16.91	
11,642.00	87.51	179.23	7,890.23	1,456.06 S	2,957.17 W	1,235,622.56	3,133,577.02	2.45	2,136.51	169.13	
11,737.00	87.72	179.43	7,894.18	1,550.97 S	2,956.06 W	1,235,527.66	3,133,578.65	0.31	2,228.25	43.58	
11,833.00	88.32	179.76	7,897.50	1,646.91 S	2,955.38 W	1,235,431.73	3,133,579.86	0.71	2,321.10	28.80	
11,928.00	88.72	179.35	7,899.95	1,741.87 S	2,954.64 W	1,235,336.77	3,133,581.12	0.60	2,412.98	-45.70	
12,023.00	89.49	178.98	7,901.44	1,836.85 S	2,953.26 W	1,235,241.80	3,133,583.02	0.90	2,504.72	-25.67	
12,119.00	89.87	178.95	7,901.97	1,932.83 S	2,951.52 W	1,235,145.84	3,133,585.28	0.40	2,597.35	-4.51	
12,214.00	90.60	178.00	7,901.58	2,027.80 S	2,949.00 W	1,235,050.89	3,133,588.33	1.26	2,688.80	-52.46	
12,310.00	91.18	177.82	7,900.09	2,123.72 S	2,945.50 W	1,234,954.99	3,133,592.36	0.63	2,780.94	-17.24	
12,405.00	89.70	180.07	7,899.36	2,218.69 S	2,943.75 W	1,234,860.03	3,133,594.63	2.83	2,872.59	123.32	
12,500.00	90.34	179.78	7,899.33	2,313.69 S	2,943.62 W	1,234,765.04	3,133,595.28	0.74	2,964.66	-24.38	
12,596.00	88.66	179.25	7,900.17	2,409.68 S	2,942.81 W	1,234,669.06	3,133,596.62	1.84	3,057.52	-162.49	
12,727.00	88.77	179.43	7,903.10	2,540.64 S	2,941.30 W	1,234,538.11	3,133,598.85	0.16	3,184.11	58.57	
12,824.00	89.26	179.48	7,904.77	2,637.62 S	2,940.38 W	1,234,441.14	3,133,600.30	0.51	3,277.91	5.83	
12,917.00	89.38	179.63	7,905.88	2,730.61 S	2,939.66 W	1,234,348.16	3,133,601.53	0.21	3,367.88	51.34	
13,013.00	89.63	179.70	7,906.70	2,826.61 S	2,939.09 W	1,234,252.17	3,133,602.62	0.27	3,460.81	15.64	
13,108.00	89.75	179.83	7,907.22	2,921.60 S	2,938.71 W	1,234,157.18	3,133,603.53	0.19	3,552.82	47.29	
13,203.00	89.88	179.82	7,907.53	3,016.60 S	2,938.42 W	1,234,062.19	3,133,604.35	0.14	3,644.85	-4.40	
13,298.00	89.81	179.74	7,907.78	3,111.60 S	2,938.05 W	1,233,967.20	3,133,605.23	0.11	3,736.86	-131.19	
13,489.00	89.44	180.04	7,909.03	3,302.60 S	2,937.68 W	1,233,776.21	3,133,606.65	0.25	3,921.94	140.97	
13,585.00	90.00	180.16	7,909.50	3,398.59 S	2,937.85 W	1,233,680.22	3,133,607.01	0.60	4,015.05	12.09	
13,680.00	90.00	180.18	7,909.50	3,493.59 S	2,938.13 W	1,233,585.22	3,133,607.25	0.02	4,107.22	90.00	
13,775.00	90.19	179.51	7,909.34	3,588.59 S	2,937.88 W	1,233,490.23	3,133,608.03	0.73	4,199.25	-74.17	
13,871.00	90.31	178.95	7,908.93	3,684.58 S	2,936.59 W	1,233,394.25	3,133,609.85	0.60	4,292.00	-77.90	
13,966.00	90.25	178.70	7,908.46	3,779.56 S	2,934.64 W	1,233,299.29	3,133,612.32	0.27	4,383.60	-103.50	
14,061.00	90.06	178.61	7,908.20	3,874.54 S	2,932.41 W	1,233,204.33	3,133,615.07	0.22	4,475.13	-154.65	



## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured Depth (usft)	Inclination (°)	True Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100usft)	Vertical Section (usft)	Toolface Angle (°)	Comments
				Northing (usft)	Easting (usft)	Northing (usft)	Easting (usft)				
14,156.00	90.00	178.87	7,908.15	3,969.51 S	2,930.32 W	1,233,109.37	3,133,617.68	0.28	4,566.70	102.99	
14,251.00	89.81	178.95	7,908.31	4,064.49 S	2,928.51 W	1,233,014.40	3,133,620.01	0.22	4,658.34	157.17	
14,346.00	89.81	179.28	7,908.63	4,159.48 S	2,927.04 W	1,232,919.43	3,133,622.00	0.35	4,750.07	90.00	
14,441.00	89.81	179.78	7,908.94	4,254.48 S	2,926.27 W	1,232,824.44	3,133,623.30	0.53	4,841.98	90.00	
14,536.00	89.88	179.87	7,909.20	4,349.48 S	2,925.98 W	1,232,729.45	3,133,624.11	0.12	4,934.01	52.13	
14,631.00	90.06	180.22	7,909.25	4,444.48 S	2,926.05 W	1,232,634.45	3,133,624.56	0.41	5,026.13	62.78	
14,727.00	90.12	179.98	7,909.10	4,540.48 S	2,926.22 W	1,232,538.45	3,133,624.92	0.26	5,119.24	-75.96	
14,822.00	90.25	180.14	7,908.79	4,635.48 S	2,926.32 W	1,232,443.46	3,133,625.34	0.22	5,211.37	50.91	
14,918.00	90.31	179.75	7,908.32	4,731.48 S	2,926.22 W	1,232,347.46	3,133,625.96	0.41	5,304.41	-81.25	
15,013.00	90.31	179.22	7,907.81	4,826.47 S	2,925.37 W	1,232,252.48	3,133,627.33	0.56	5,396.30	-90.00	
15,109.00	89.94	178.41	7,907.60	4,922.45 S	2,923.39 W	1,232,156.52	3,133,629.85	0.93	5,488.86	-114.55	
15,204.00	89.88	177.74	7,907.75	5,017.39 S	2,920.19 W	1,232,061.59	3,133,633.56	0.71	5,580.13	-95.12	
15,299.00	90.06	177.83	7,907.80	5,112.32 S	2,916.52 W	1,231,966.69	3,133,637.75	0.21	5,671.26	26.57	
15,394.00	90.19	177.61	7,907.59	5,207.25 S	2,912.74 W	1,231,871.79	3,133,642.05	0.27	5,762.37	-59.42	
15,490.00	90.25	177.93	7,907.22	5,303.17 S	2,909.01 W	1,231,775.89	3,133,646.31	0.34	5,854.45	79.38	
15,585.00	90.25	177.51	7,906.81	5,398.10 S	2,905.23 W	1,231,680.99	3,133,650.62	0.44	5,945.55	-90.00	
15,680.00	90.25	177.71	7,906.39	5,493.01 S	2,901.27 W	1,231,586.10	3,133,655.10	0.21	6,036.60	90.00	
15,775.00	90.31	177.97	7,905.93	5,587.94 S	2,897.69 W	1,231,491.19	3,133,659.20	0.28	6,127.76	77.00	
15,869.00	90.43	178.24	7,905.32	5,681.89 S	2,894.58 W	1,231,397.27	3,133,662.82	0.31	6,218.08	66.04	
15,964.00	90.25	178.59	7,904.76	5,776.85 S	2,891.95 W	1,231,302.32	3,133,665.97	0.41	6,309.50	117.22	
16,060.00	90.06	178.29	7,904.50	5,872.82 S	2,889.34 W	1,231,206.38	3,133,669.11	0.37	6,401.89	-122.35	
16,155.00	90.31	178.62	7,904.19	5,967.78 S	2,886.78 W	1,231,111.43	3,133,672.20	0.44	6,493.33	52.85	
16,251.00	90.43	178.92	7,903.57	6,063.76 S	2,884.71 W	1,231,015.47	3,133,674.79	0.34	6,585.88	68.20	
16,346.00	90.12	179.76	7,903.12	6,158.75 S	2,883.62 W	1,230,920.49	3,133,676.40	0.94	6,677.70	110.25	
16,442.00	89.94	180.41	7,903.07	6,254.75 S	2,883.76 W	1,230,824.50	3,133,676.79	0.70	6,770.81	105.48	
16,537.00	89.81	181.21	7,903.27	6,349.74 S	2,885.11 W	1,230,729.50	3,133,675.97	0.85	6,863.23	99.23	
16,632.00	89.69	182.36	7,903.69	6,444.69 S	2,888.07 W	1,230,634.54	3,133,673.53	1.22	6,956.01	95.96	
16,727.00	89.81	182.71	7,904.10	6,539.60 S	2,892.27 W	1,230,539.62	3,133,669.85	0.39	7,049.05	71.08	
16,823.00	89.75	183.23	7,904.47	6,635.47 S	2,897.24 W	1,230,443.72	3,133,665.40	0.55	7,143.21	96.58	
16,918.00	89.26	183.50	7,905.29	6,730.30 S	2,902.82 W	1,230,348.87	3,133,660.35	0.59	7,236.52	151.15	
17,013.00	89.38	183.58	7,906.42	6,825.11 S	2,908.68 W	1,230,254.03	3,133,655.00	0.15	7,329.88	33.69	
17,109.00	89.32	184.14	7,907.51	6,920.89 S	2,915.14 W	1,230,158.22	3,133,649.07	0.59	7,424.31	96.12	
17,204.00	89.14	184.29	7,908.78	7,015.62 S	2,922.13 W	1,230,063.45	3,133,642.61	0.25	7,517.87	140.20	
17,299.00	89.38	184.11	7,910.01	7,110.36 S	2,929.08 W	1,229,968.68	3,133,636.17	0.32	7,611.42	-36.87	
17,394.00	89.88	184.13	7,910.62	7,205.11 S	2,935.91 W	1,229,873.89	3,133,629.87	0.53	7,704.95	2.29	
17,489.00	90.00	183.45	7,910.72	7,299.90 S	2,942.19 W	1,229,779.07	3,133,624.11	0.73	7,798.39	-79.99	
17,585.00	90.00	183.55	7,910.72	7,395.72 S	2,948.05 W	1,229,683.22	3,133,618.77	0.10	7,892.73	90.00	

## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured Depth (usft)	Inclination (°)	True Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100usft)	Vertical Section (usft)	Toolface Angle (°)	Comments
				Northing (usft)	Easting (usft)	Northing (usft)	Easting (usft)				
17,680.00	90.12	183.24	7,910.62	7,490.55 S	2,953.67 W	1,229,588.36	3,133,613.67	0.35	7,986.05	-68.84	
17,775.00	90.37	182.96	7,910.22	7,585.41 S	2,958.81 W	1,229,493.48	3,133,609.05	0.40	8,079.27	-48.24	
17,870.00	90.43	182.63	7,909.55	7,680.30 S	2,963.44 W	1,229,398.58	3,133,604.94	0.35	8,172.40	-79.69	
17,964.00	90.49	182.46	7,908.80	7,774.20 S	2,967.62 W	1,229,304.65	3,133,601.28	0.19	8,264.46	-70.56	
18,060.00	90.56	182.03	7,907.92	7,870.13 S	2,971.38 W	1,229,208.71	3,133,598.05	0.45	8,358.38	-80.75	
18,154.00	90.68	181.30	7,906.90	7,964.08 S	2,974.11 W	1,229,114.75	3,133,595.84	0.79	8,450.13	-80.66	
18,248.00	90.74	181.00	7,905.74	8,058.05 S	2,976.00 W	1,229,020.77	3,133,594.47	0.33	8,541.70	-78.69	
18,343.00	90.74	180.95	7,904.51	8,153.03 S	2,977.61 W	1,228,925.79	3,133,593.37	0.05	8,634.18	-90.00	
18,438.00	90.56	181.09	7,903.43	8,248.01 S	2,979.30 W	1,228,830.80	3,133,592.20	0.24	8,726.68	142.13	
18,627.00	90.25	180.96	7,902.10	8,436.98 S	2,982.68 W	1,228,641.83	3,133,589.86	0.18	8,910.70	-157.25	
18,722.00	90.25	180.60	7,901.68	8,531.97 S	2,983.98 W	1,228,546.84	3,133,589.09	0.38	9,003.11	-90.00	
18,816.00	90.19	179.69	7,901.32	8,625.96 S	2,984.22 W	1,228,452.84	3,133,589.37	0.97	9,094.30	-93.77	
18,912.00	90.06	179.47	7,901.11	8,721.96 S	2,983.51 W	1,228,356.85	3,133,590.60	0.27	9,187.20	-120.58	
19,006.00	90.19	178.94	7,900.91	8,815.95 S	2,982.21 W	1,228,262.87	3,133,592.42	0.58	9,278.00	-76.22	
19,101.00	90.06	177.99	7,900.70	8,910.92 S	2,979.66 W	1,228,167.93	3,133,595.48	1.01	9,369.45	-97.79	
19,196.00	90.06	176.59	7,900.60	9,005.81 S	2,975.17 W	1,228,073.07	3,133,600.50	1.47	9,460.34	-90.00	
19,291.00	90.12	177.30	7,900.45	9,100.67 S	2,970.11 W	1,227,978.23	3,133,606.08	0.75	9,551.07	85.17	
19,387.00	90.06	177.69	7,900.30	9,196.58 S	2,965.91 W	1,227,882.35	3,133,610.80	0.41	9,643.02	98.75	
19,482.00	89.81	178.72	7,900.41	9,291.53 S	2,962.94 W	1,227,787.42	3,133,614.30	1.12	9,734.35	103.64	
19,577.00	89.94	179.31	7,900.62	9,386.52 S	2,961.30 W	1,227,692.45	3,133,616.46	0.64	9,826.04	77.57	
19,673.00	90.19	179.34	7,900.51	9,482.51 S	2,960.17 W	1,227,596.47	3,133,618.11	0.26	9,918.82	6.84	
19,863.00	90.31	178.64	7,899.68	9,672.48 S	2,956.82 W	1,227,406.53	3,133,622.51	0.37	10,102.17	-80.27	
19,957.00	90.56	178.72	7,898.96	9,766.45 S	2,954.66 W	1,227,312.57	3,133,625.19	0.28	10,192.75	17.74	
20,052.00	90.49	178.74	7,898.09	9,861.42 S	2,952.55 W	1,227,217.62	3,133,627.82	0.08	10,284.31	164.06	
20,147.00	90.56	179.18	7,897.22	9,956.40 S	2,950.83 W	1,227,122.65	3,133,630.06	0.47	10,375.97	80.96	
20,243.00	90.37	179.68	7,896.44	10,052.39 S	2,949.87 W	1,227,026.67	3,133,631.54	0.56	10,468.80	110.81	
20,338.00	90.37	180.27	7,895.83	10,147.39 S	2,949.83 W	1,226,931.68	3,133,632.11	0.62	10,560.89	90.00	
20,434.00	90.43	180.04	7,895.16	10,243.39 S	2,950.09 W	1,226,835.68	3,133,632.38	0.25	10,654.02	-75.38	
20,624.00	90.19	179.22	7,894.13	10,433.38 S	2,948.86 W	1,226,645.71	3,133,634.65	0.45	10,837.91	-106.31	
20,719.00	90.12	179.10	7,893.88	10,528.37 S	2,947.47 W	1,226,550.73	3,133,636.56	0.15	10,929.66	-120.26	
20,815.00	90.19	178.60	7,893.62	10,624.35 S	2,945.55 W	1,226,454.76	3,133,639.01	0.53	11,022.24	-82.03	
20,909.00	90.12	178.57	7,893.36	10,718.32 S	2,943.22 W	1,226,360.81	3,133,641.85	0.08	11,112.78	-156.80	
21,005.00	90.12	178.47	7,893.16	10,814.29 S	2,940.74 W	1,226,264.86	3,133,644.86	0.10	11,205.21	-90.00	
21,099.00	90.19	178.44	7,892.91	10,908.25 S	2,938.21 W	1,226,170.91	3,133,647.91	0.08	11,295.69	-23.20	
21,194.00	90.25	178.48	7,892.54	11,003.22 S	2,935.66 W	1,226,075.97	3,133,650.98	0.08	11,387.13	33.69	
21,385.00	90.43	177.92	7,891.41	11,194.12 S	2,929.66 W	1,225,885.11	3,133,658.03	0.31	11,570.74	-72.18	
21,481.00	90.55	177.88	7,890.59	11,290.05 S	2,926.14 W	1,225,789.20	3,133,662.08	0.13	11,662.88	-18.43	

## Design Report for NORTHWEST A S20-25-12N - Final Surveys

Measured Depth (usft)	Inclination (°)	True Azimuth (°)	Vertical Depth (usft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100usft)	Vertical Section (usft)	Toolface Angle (°)	Comments
				Northing (usft)	Easting (usft)	Northing (usft)	Easting (usft)				
21,576.00	90.56	178.05	7,889.67	11,384.99 S	2,922.77 W	1,225,694.29	3,133,665.97	0.18	11,754.09	86.63	Final Sperry MWD Survey at 21576.00' MD
21,610.00	90.56	178.05	7,889.33	11,418.97 S	2,921.61 W	1,225,660.32	3,133,667.31	0.00	11,786.75	0.00	Straight Line Projection to TD at 21610.00' MD

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
131.00	131.00	-0.06	0.30	First Atlas MWD Survey at 131.00' MD
1,550.00	1,549.84	6.34	0.12	Final Atlas MWD Survey at 1550.00' MD
1,736.00	1,735.40	10.39	-11.91	First Sperry MWD Survey at 1736.00' MD
21,576.00	7,889.67	-11,384.99	-2,922.77	Final Sperry MWD Survey at 21576.00' MD
21,610.00	7,889.33	-11,418.97	-2,921.61	Straight Line Projection to TD at 21610.00' MD

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (usft)
				+N/-S (usft)	+E/-W (usft)	
Target	NORTHWEST A S20-25-12N_Plat BHL	194.19	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
131.00	1,550.00	Atlas MWD Surveys	3_MWD
1,736.00	21,576.00	Sperry MWD Surveys	3_MWD
21,610.00	21,610.00	PTB - No Survey	3_Blind

Design Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (°)	+N/-S (°)	+E/-W (°)	Northing (°)	Easting (°)	Latitude	Longitude
- hit/miss target									
- Shape									
( )									

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Design Report for NORTHWEST A S20-25-12N - Final Surveys

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Directional Difficulty Index

Average Dogleg over Survey: 1.69 °/100usft

Maximum Dogleg over Survey: 14.50 °/100usft at 9,266.00  
usft

Net Tortosity applicable to Plans: 0.76 °/100usft

Directional Difficulty Index: 7.205

Audit Info

**North Reference Sheet for Sec. 09-T01S-R68W (NORTHWEST A S20-25 Pad) - NORTHWEST A S20-25-12N - OWB\_20786**

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.

Vertical Depths are relative to KB = 29' @ 5343.00usft (Patterson 901). Northing and Easting are relative to NORTHWEST A S20-25-12N

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99996769

Grid Coordinates of Well: 1,237,094.79 usft N, 3,136,526.05 usft E

Geographical Coordinates of Well: 39.983180, -105.012792

Grid Convergence at Surface is: 0.31°

Based upon Minimum Curvature type calculations, at a Measured Depth of 21,610.00usft  
the Bottom Hole Displacement is 11,786.80usft in the Direction of 194.35° (True).

Magnetic Convergence at surface is: -7.94° ( 1 November 2019, , BGGM2018)

