

BISON EXPLORATION

**ARAPAHOE COUNTY, COLORADO (NAD 83)
SE NE SEC. 22 T4S R64W 6th P.M.
HOULIHAN 4-64 22A 21-5**

ORIGINAL WELLBORE

30 March, 2017

Plan: PROPOSAL #1



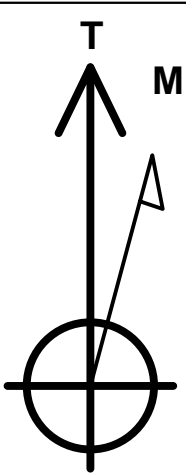
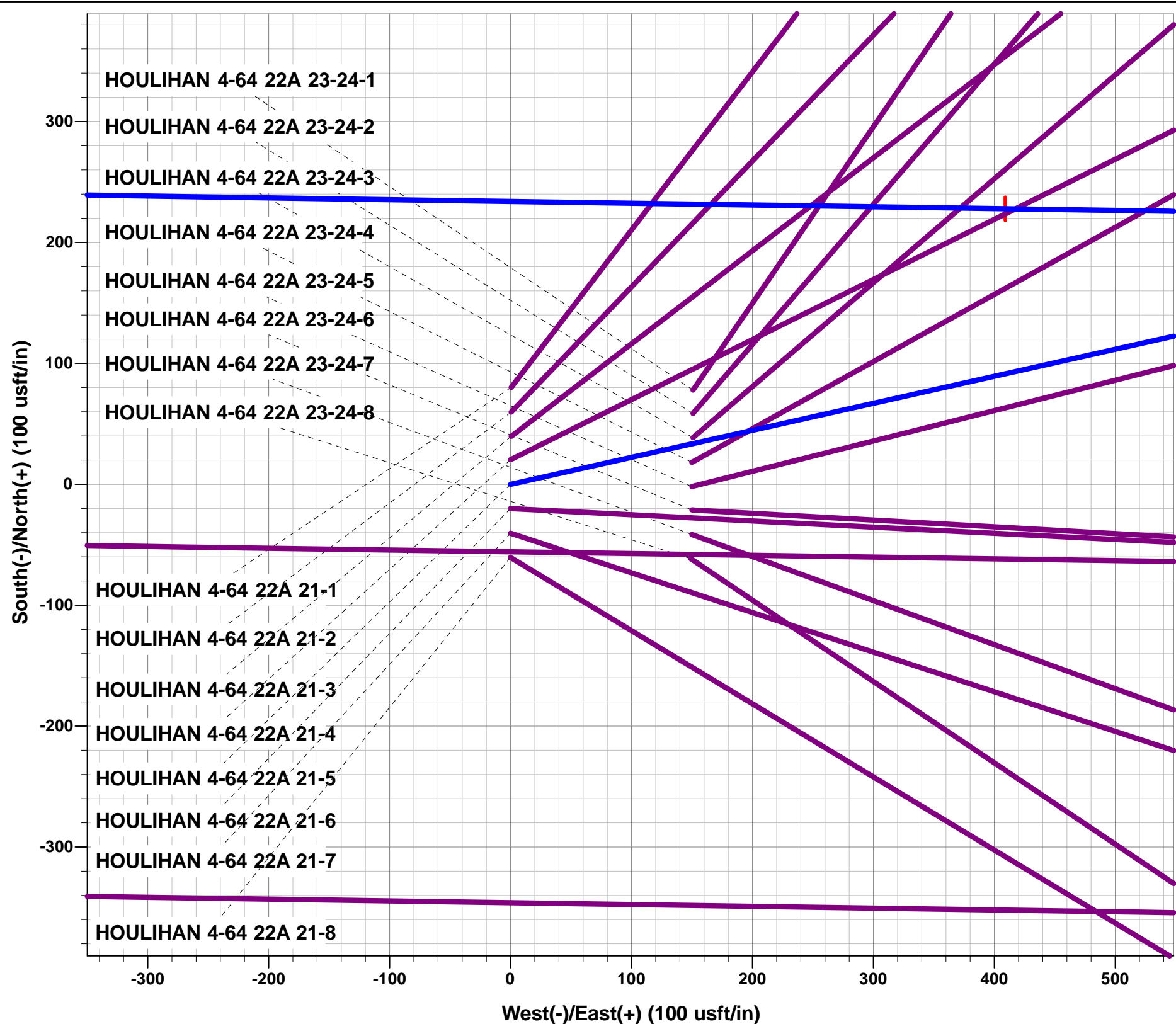
Project: ARAPAHOE COUNTY, COLORADO (NAD 83)
Site: SE NE SEC. 22 T4S R64W 6th P.M.
Well: HOULIHAN 4-64 22A 21-5
Wellbore: ORIGINAL WELLBORE
Design: PROPOSAL #1

ANNOTATIONS

TVD	MD	Inc	Azi	+N/-S	+E/-W	VSect	Dep	Annotation
0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	SHL: 1854ft FNL & 1005ft FEL of Sec 22
500.0	500.0	0.00	0.00	0.0	0.0	0.0	0.0	START NUDGE (2°/100ft BUR)
1095.8	1100.1	12.00	77.41	13.7	61.1	-60.5	62.6	EOB TO 12° INC
5239.7	5336.7	12.00	77.41	205.7	921.0	-911.9	943.7	END OF TANGENT
5835.5	5936.9	0.00	0.00	219.4	982.1	-972.4	1006.3	EOD TO VERTICAL
7035.5	7136.9	0.00	0.00	219.4	982.1	-972.4	1006.3	KOP (10°/100ft BUR)
7591.6	7897.6	76.07	270.85	225.9	547.1	-537.5	1441.4	BEGIN PROD INTERVAL
7608.5	8036.9	90.00	270.85	227.9	409.2	-399.6	1579.3	HZ LP *NEW*: 1620ft FNL & 597.9ft FEL of Sec 22
7608.5	17519.0	90.00	270.84	368.1	-9071.9	9079.4	11061.4	BHL: 1620ft FNL & 460ft FWL of Sec 21

WELLBORE TARGET DETAILS (LAT/LONG)

Name	TVD	+N/-S	+E/-W	Latitude	Longitude
KOP - HOULIHAN 4-64 22A 21-5	7035.5	219.4	982.1	39.690799	-104.527718
BHL - HOULIHAN 4-64 22A 21-5	7608.5	368.1	-9071.9	39.691203	-104.563444
HZ LP *NEW* - HOULIHAN 4-64 22A 21-5	7608.5	227.9	409.2	39.690823	-104.529754



Azimuths to True North
Magnetic North: 8.05°

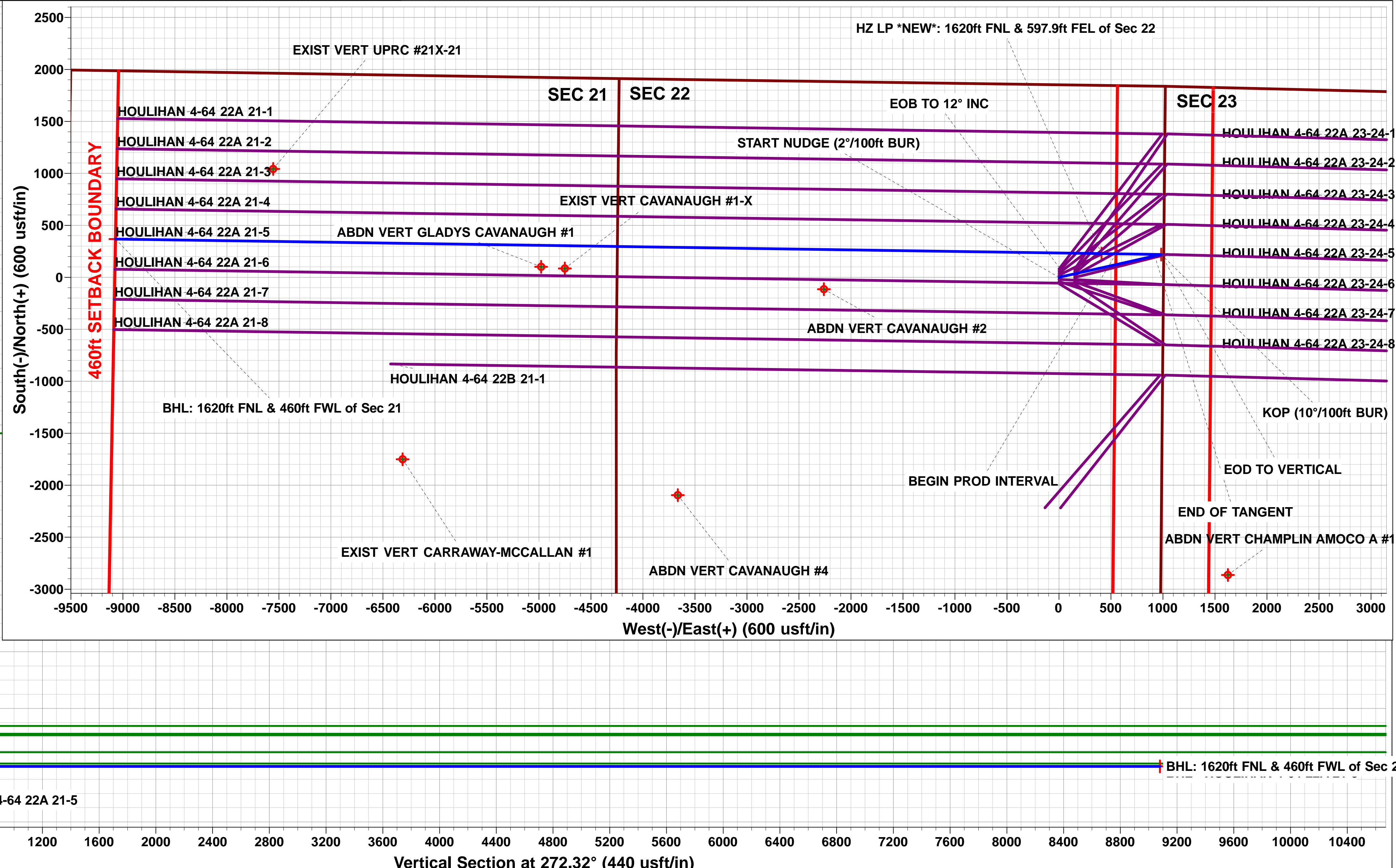
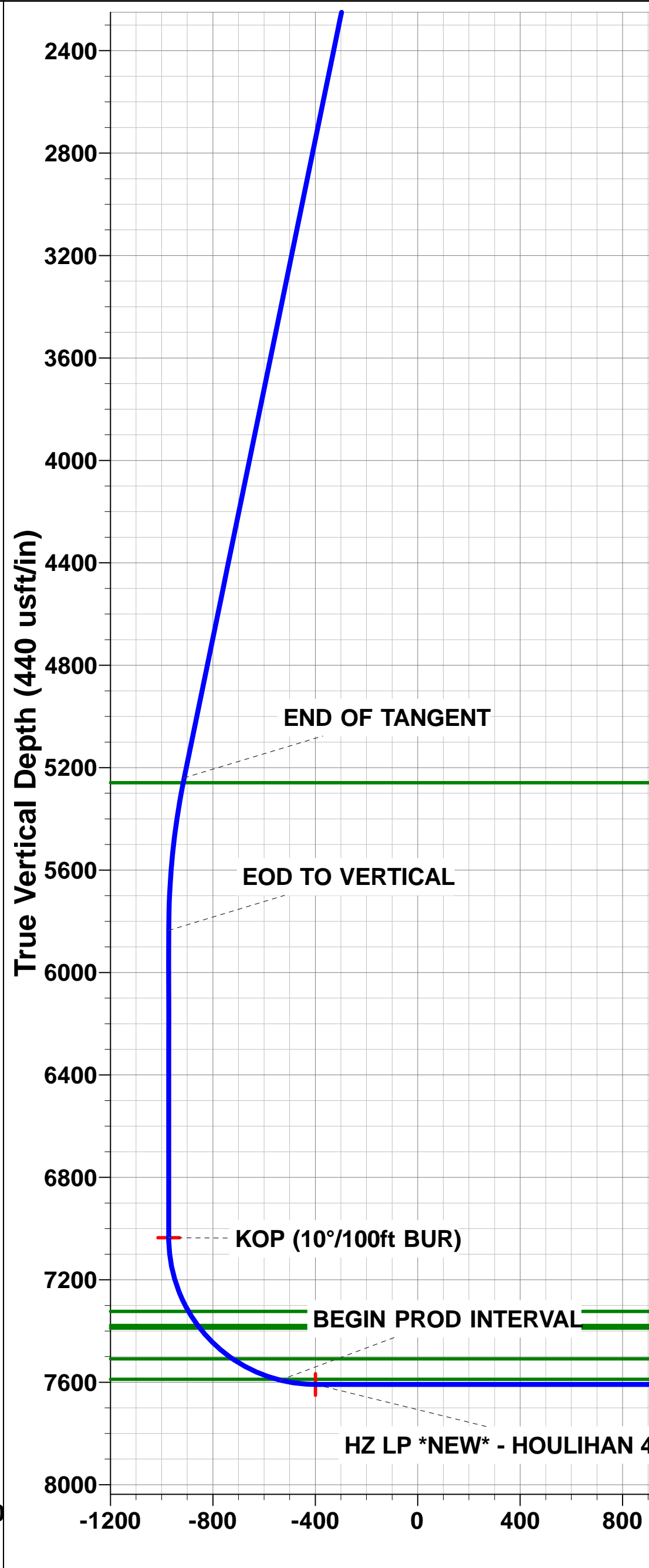
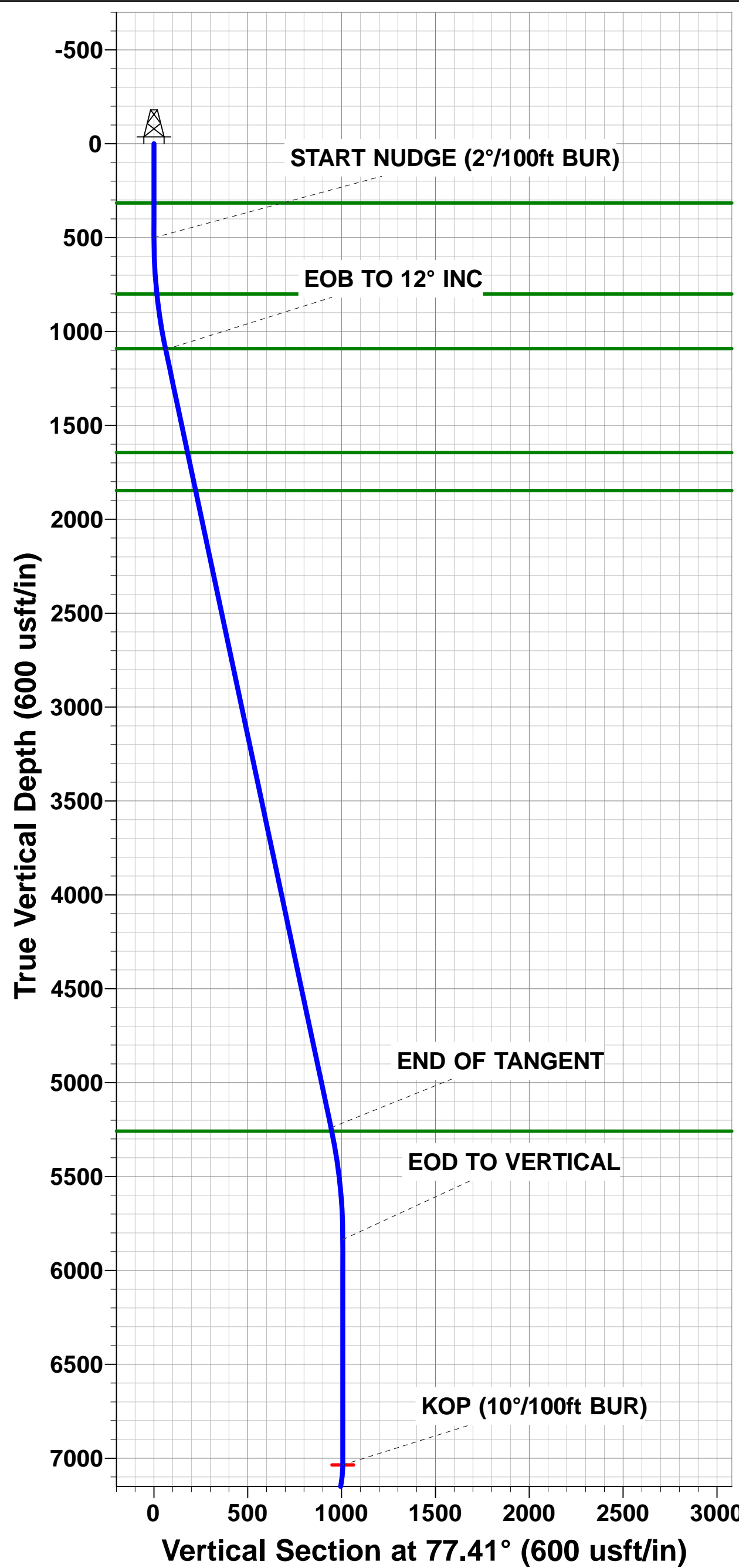
Magnetic Field
Strength: 52062.8nT
Dip Angle: 66.33°
Date: 30/03/2017
Model: IGRF2015

FORMATION TOP DETAILS

TVDPath	MDPath	Formation
315.5	315.5	DENVER
800.5	801.1	UPPER ARAPAHOE
1090.5	1094.8	LOWER ARAPAHOE
1644.5	1661.1	LARAMIE - FOX HILLS
1846.5	1867.7	PIERRE SHALE
5258.5	5355.9	SHANNON SANDSTONE MBR
7323.5	7438.6	SHARON SPRINGS SHALE
7378.5	7504.6	NIOBRARA FORMATION
7388.5	7517.2	NIOBRARA A CHALK
7508.5	7693.3	NIOBRARA B CHALK
7588.5	7885.2	NIOBRARA C CHALK

PROPOSED LOCAL COORDINATES:

SHL: 1854ft FNL & 1005ft FEL of Sec 22
BEGIN PROD INT: 1620ft FNL & 460ft FEL of Sec 22
HZ LP: 1620ft FNL & 597.9ft FEL of Sec 22
BHL: 1620ft FNL & 460ft FWL of Sec 21



Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-5
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-5	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Project	ARAPAHOE COUNTY, COLORADO (NAD 83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		Using geodetic scale factor

Site	SE NE SEC. 22 T4S R64W 6th P.M.		
Site Position:		Northing:	1,677,817.09 usft
From:	Lat/Long	Easting:	3,272,633.76 usft
Position Uncertainty:	0.0 usft	Slot Radius:	1.10000ft
		Latitude:	39.690417
		Longitude:	-104.531206
		Grid Convergence:	0.61 °

Well	HOULIHAN 4-64 22A 21-5		
Well Position	+N-S	-80.1 usft	Northing:
	+E-W	-0.6 usft	Easting:
Position Uncertainty	0.0 usft		Wellhead Elevation:
			Latitude:
			Longitude:
			Ground Level:

Wellbore	ORIGINAL WELLBORE				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	30/03/2017	8.05	66.33	52,063

Design	PROPOSAL #1			
Audit Notes:				
Version:	Phase:	PROTOTYPE	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N-S (usft)	+E-W (usft)	Direction (°)
	7,608.5	0.0	0.0	272.32

Plan Sections											
MD (usft)	Inc (°)	Azi (°)	Vertical Depth	SS (usft)	+N-S (usft)	+E-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.0	0.00	0.00	0.0	-5,728.5	0.0	0.0	0.00	0.00	0.00	0.00	
500.0	0.00	0.00	500.0	-5,228.5	0.0	0.0	0.00	0.00	0.00	0.00	
1,100.1	12.00	77.41	1,095.8	-4,632.7	13.7	61.1	2.00	2.00	0.00	77.41	
5,336.7	12.00	77.41	5,239.7	-488.8	205.7	921.0	0.00	0.00	0.00	0.00	
5,936.9	0.00	0.00	5,835.5	107.0	219.4	982.1	2.00	-2.00	0.00	180.00	
7,136.9	0.00	0.00	7,035.5	1,307.0	219.4	982.1	0.00	0.00	0.00	0.00	KOP - HOULIHAN 4
8,036.9	90.00	270.85	7,608.5	1,880.0	227.9	409.2	10.00	10.00	0.00	270.85	
17,519.0	90.00	270.84	7,608.5	1,880.0	368.1	-9,071.9	0.00	0.00	0.00	-94.88	BHL - HOULIHAN 4

Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-5
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-5	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey

MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
SHL: 1854ft FNL & 1005ft FEL of Sec 22										
0.0	0.00	0.00	0.0	5,728.50	0.0	0.0	0.0	0.00	0.00	0.00
100.0	0.00	0.00	100.0	5,628.50	0.0	0.0	0.0	0.00	0.00	0.00
200.0	0.00	0.00	200.0	5,528.50	0.0	0.0	0.0	0.00	0.00	0.00
300.0	0.00	0.00	300.0	5,428.50	0.0	0.0	0.0	0.00	0.00	0.00
DENVER										
315.5	0.00	0.00	315.5	5,413.00	0.0	0.0	0.0	0.00	0.00	0.00
400.0	0.00	0.00	400.0	5,328.50	0.0	0.0	0.0	0.00	0.00	0.00
START NUDGE (2°/100ft BUR)										
500.0	0.00	0.00	500.0	5,228.50	0.0	0.0	0.0	0.00	0.00	0.00
600.0	2.00	77.41	600.0	5,128.52	0.4	1.7	-1.7	2.00	2.00	0.00
700.0	4.00	77.41	699.8	5,028.66	1.5	6.8	-6.7	2.00	2.00	0.00
800.0	6.00	77.41	799.5	4,929.05	3.4	15.3	-15.2	2.00	2.00	0.00
UPPER ARAPAHOE										
801.1	6.02	77.41	800.5	4,928.00	3.4	15.4	-15.3	2.00	2.00	0.00
900.0	8.00	77.41	898.7	4,829.80	6.1	27.2	-26.9	2.00	2.00	0.00
1,000.0	10.00	77.41	997.5	4,731.03	9.5	42.5	-42.1	2.00	2.00	0.00
LOWER ARAPAHOE										
1,094.8	11.90	77.41	1,090.5	4,638.00	13.4	60.0	-59.4	2.00	2.00	0.00
1,100.0	12.00	77.41	1,095.6	4,632.88	13.6	61.1	-60.5	2.00	2.00	0.00
EOB TO 12° INC										
1,100.1	12.00	77.41	1,095.8	4,632.74	13.7	61.1	-60.5	2.00	2.00	0.00
1,200.0	12.00	77.41	1,193.4	4,535.06	18.2	81.4	-80.6	0.00	0.00	0.00
1,300.0	12.00	77.41	1,291.3	4,437.25	22.7	101.7	-100.7	0.00	0.00	0.00
1,400.0	12.00	77.41	1,389.1	4,339.44	27.3	122.0	-120.8	0.00	0.00	0.00
1,500.0	12.00	77.41	1,486.9	4,241.62	31.8	142.3	-140.9	0.00	0.00	0.00
1,600.0	12.00	77.41	1,584.7	4,143.81	36.3	162.6	-161.0	0.00	0.00	0.00
LARAMIE - FOX HILLS										
1,661.1	12.00	77.41	1,644.5	4,084.00	39.1	175.0	-173.3	0.00	0.00	0.00
1,700.0	12.00	77.41	1,682.5	4,045.99	40.9	182.9	-181.1	0.00	0.00	0.00
1,800.0	12.00	77.41	1,780.3	3,948.18	45.4	203.2	-201.2	0.00	0.00	0.00
PIERRE SHALE (BASE FOX HILLS)										
1,867.7	12.00	77.41	1,846.5	3,882.00	48.5	216.9	-214.8	0.00	0.00	0.00
1,900.0	12.00	77.41	1,878.1	3,850.37	49.9	223.5	-221.3	0.00	0.00	0.00
2,000.0	12.00	77.41	1,975.9	3,752.55	54.5	243.8	-241.4	0.00	0.00	0.00
2,100.0	12.00	77.41	2,073.8	3,654.74	59.0	264.1	-261.4	0.00	0.00	0.00
2,200.0	12.00	77.41	2,171.6	3,556.93	63.5	284.3	-281.5	0.00	0.00	0.00
2,300.0	12.00	77.41	2,269.4	3,459.11	68.1	304.6	-301.6	0.00	0.00	0.00
2,400.0	12.00	77.41	2,367.2	3,361.30	72.6	324.9	-321.7	0.00	0.00	0.00
2,500.0	12.00	77.41	2,465.0	3,263.48	77.1	345.2	-341.8	0.00	0.00	0.00
2,600.0	12.00	77.41	2,562.8	3,165.67	81.7	365.5	-361.9	0.00	0.00	0.00
2,700.0	12.00	77.41	2,660.6	3,067.86	86.2	385.8	-382.0	0.00	0.00	0.00
2,800.0	12.00	77.41	2,758.5	2,970.04	90.7	406.1	-402.1	0.00	0.00	0.00
2,900.0	12.00	77.41	2,856.3	2,872.23	95.3	426.4	-422.2	0.00	0.00	0.00
3,000.0	12.00	77.41	2,954.1	2,774.42	99.8	446.7	-442.3	0.00	0.00	0.00
3,100.0	12.00	77.41	3,051.9	2,676.60	104.3	467.0	-462.4	0.00	0.00	0.00
3,200.0	12.00	77.41	3,149.7	2,578.79	108.9	487.3	-482.5	0.00	0.00	0.00
3,300.0	12.00	77.41	3,247.5	2,480.97	113.4	507.6	-502.6	0.00	0.00	0.00
3,400.0	12.00	77.41	3,345.3	2,383.16	117.9	527.9	-522.7	0.00	0.00	0.00
3,500.0	12.00	77.41	3,443.2	2,285.35	122.5	548.2	-542.8	0.00	0.00	0.00
3,600.0	12.00	77.41	3,541.0	2,187.53	127.0	568.5	-562.9	0.00	0.00	0.00
3,700.0	12.00	77.41	3,638.8	2,089.72	131.5	588.8	-583.0	0.00	0.00	0.00
3,800.0	12.00	77.41	3,736.6	1,991.91	136.1	609.1	-603.1	0.00	0.00	0.00

Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-5
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-5	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey										
MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
3,900.0	12.00	77.41	3,834.4	1,894.09	140.6	629.4	-623.2	0.00	0.00	0.00
4,000.0	12.00	77.41	3,932.2	1,796.28	145.1	649.7	-643.3	0.00	0.00	0.00
4,100.0	12.00	77.41	4,030.0	1,698.47	149.7	670.0	-663.4	0.00	0.00	0.00
4,200.0	12.00	77.41	4,127.8	1,600.65	154.2	690.3	-683.4	0.00	0.00	0.00
4,300.0	12.00	77.41	4,225.7	1,502.84	158.7	710.6	-703.5	0.00	0.00	0.00
4,400.0	12.00	77.41	4,323.5	1,405.02	163.3	730.9	-723.6	0.00	0.00	0.00
4,500.0	12.00	77.41	4,421.3	1,307.21	167.8	751.2	-743.7	0.00	0.00	0.00
4,600.0	12.00	77.41	4,519.1	1,209.40	172.3	771.4	-763.8	0.00	0.00	0.00
4,700.0	12.00	77.41	4,616.9	1,111.58	176.9	791.7	-783.9	0.00	0.00	0.00
4,800.0	12.00	77.41	4,714.7	1,013.77	181.4	812.0	-804.0	0.00	0.00	0.00
4,900.0	12.00	77.41	4,812.5	915.96	185.9	832.3	-824.1	0.00	0.00	0.00
5,000.0	12.00	77.41	4,910.4	818.14	190.5	852.6	-844.2	0.00	0.00	0.00
5,100.0	12.00	77.41	5,008.2	720.33	195.0	872.9	-864.3	0.00	0.00	0.00
5,200.0	12.00	77.41	5,106.0	622.51	199.5	893.2	-884.4	0.00	0.00	0.00
5,300.0	12.00	77.41	5,203.8	524.70	204.1	913.5	-904.5	0.00	0.00	0.00
END OF TANGENT										
5,336.7	12.00	77.41	5,239.7	488.76	205.7	921.0	-911.9	0.00	0.00	0.00
SHANNON SANDSTONE MBR										
5,355.9	11.62	77.41	5,258.5	470.00	206.6	924.8	-915.7	2.00	-2.00	0.00
5,400.0	10.74	77.41	5,301.8	426.75	208.5	933.1	-923.9	2.00	-2.00	0.00
5,500.0	8.74	77.41	5,400.3	328.19	212.2	949.7	-940.3	2.00	-2.00	0.00
5,600.0	6.74	77.41	5,499.4	229.11	215.1	962.8	-953.3	2.00	-2.00	0.00
5,700.0	4.74	77.41	5,598.9	129.61	217.3	972.5	-962.9	2.00	-2.00	0.00
5,800.0	2.74	77.41	5,698.7	29.83	218.7	978.9	-969.2	2.00	-2.00	0.00
5,900.0	0.74	77.41	5,798.6	-70.12	219.3	981.9	-972.2	2.00	-2.00	0.00
EOD TO VERTICAL										
5,936.9	0.00	0.00	5,835.5	-107.00	219.4	982.1	-972.4	2.00	-2.00	0.00
6,000.0	0.00	0.00	5,898.6	-170.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,100.0	0.00	0.00	5,998.6	-270.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,200.0	0.00	0.00	6,098.6	-370.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,300.0	0.00	0.00	6,198.6	-470.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,400.0	0.00	0.00	6,298.6	-570.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,500.0	0.00	0.00	6,398.6	-670.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,600.0	0.00	0.00	6,498.6	-770.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,700.0	0.00	0.00	6,598.6	-870.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,800.0	0.00	0.00	6,698.6	-970.12	219.4	982.1	-972.4	0.00	0.00	0.00
6,900.0	0.00	0.00	6,798.6	-1,070.12	219.4	982.1	-972.4	0.00	0.00	0.00
7,000.0	0.00	0.00	6,898.6	-1,170.12	219.4	982.1	-972.4	0.00	0.00	0.00
7,100.0	0.00	0.00	6,998.6	-1,270.12	219.4	982.1	-972.4	0.00	0.00	0.00
KOP (10°/100ft BUR)										
7,136.9	0.00	0.00	7,035.5	-1,307.00	219.4	982.1	-972.4	0.00	0.00	0.00
7,200.0	6.31	270.85	7,098.5	-1,369.99	219.5	978.6	-968.9	10.00	10.00	0.00
7,300.0	16.31	270.85	7,196.4	-1,467.92	219.7	959.0	-949.3	10.00	10.00	0.00
7,400.0	26.31	270.85	7,289.5	-1,560.97	220.3	922.7	-913.1	10.00	10.00	0.00
SHARON SPRINGS SHALE										
7,438.6	30.18	270.85	7,323.5	-1,595.00	220.6	904.5	-894.8	10.00	10.00	0.00
7,500.0	36.31	270.85	7,374.8	-1,646.29	221.1	870.8	-861.2	10.00	10.00	0.00
NIOBRARA FORMATION										
7,504.6	36.77	270.85	7,378.5	-1,650.00	221.1	868.1	-858.4	10.00	10.00	0.00
NIOBRARA A CHALK										
7,517.2	38.03	270.85	7,388.5	-1,660.00	221.2	860.5	-850.8	10.00	10.00	0.00
7,600.0	46.31	270.85	7,449.8	-1,721.31	222.0	804.9	-795.3	10.00	10.00	0.00
NIOBRARA B CHALK										

Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-5
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-5	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey

MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
7,693.3	55.64	270.85	7,508.5	-1,780.00	223.1	732.5	-722.9	10.00	10.00	0.00
7,700.0	56.31	270.85	7,512.2	-1,783.74	223.2	727.0	-717.3	10.00	10.00	0.00
7,800.0	66.31	270.85	7,560.2	-1,831.68	224.5	639.4	-629.7	10.00	10.00	0.00
NIORARA C CHALK										
7,885.2	74.83	270.85	7,588.5	-1,860.00	225.7	559.1	-549.5	10.00	10.00	0.00
BEGIN PROD INTERVAL										
7,897.6	76.07	270.85	7,591.6	-1,863.11	225.9	547.1	-537.5	10.00	10.00	0.00
7,900.0	76.31	270.85	7,592.2	-1,863.68	225.9	544.8	-535.2	10.00	10.00	0.00
8,000.0	86.31	270.85	7,607.3	-1,878.77	227.4	446.1	-436.5	10.00	10.00	0.00
HZ LP *NEW*: 1620ft FNL & 597.9ft FEL of Sec 22										
8,036.9	90.00	270.85	7,608.5	-1,879.96	227.9	409.2	-399.6	10.00	10.00	0.00
8,100.0	90.00	270.85	7,608.5	-1,879.96	228.8	346.1	-336.5	0.00	0.00	0.00
8,200.0	90.00	270.85	7,608.5	-1,879.96	230.3	246.1	-236.6	0.00	0.00	0.00
8,300.0	90.00	270.85	7,608.5	-1,879.96	231.8	146.1	-136.6	0.00	0.00	0.00
8,400.0	90.00	270.85	7,608.5	-1,879.96	233.3	46.1	-36.6	0.00	0.00	0.00
8,500.0	90.00	270.85	7,608.5	-1,879.96	234.8	-53.9	63.3	0.00	0.00	0.00
8,600.0	90.00	270.85	7,608.5	-1,879.96	236.3	-153.8	163.3	0.00	0.00	0.00
8,700.0	90.00	270.85	7,608.5	-1,879.96	237.7	-253.8	263.3	0.00	0.00	0.00
8,800.0	90.00	270.85	7,608.5	-1,879.96	239.2	-353.8	363.2	0.00	0.00	0.00
8,900.0	90.00	270.85	7,608.5	-1,879.96	240.7	-453.8	463.2	0.00	0.00	0.00
9,000.0	90.00	270.85	7,608.5	-1,879.96	242.2	-553.8	563.2	0.00	0.00	0.00
9,100.0	90.00	270.85	7,608.5	-1,879.96	243.7	-653.8	663.1	0.00	0.00	0.00
9,200.0	90.00	270.85	7,608.5	-1,879.96	245.1	-753.8	763.1	0.00	0.00	0.00
9,300.0	90.00	270.85	7,608.5	-1,879.96	246.6	-853.8	863.1	0.00	0.00	0.00
9,400.0	90.00	270.85	7,608.5	-1,879.96	248.1	-953.8	963.0	0.00	0.00	0.00
9,500.0	90.00	270.85	7,608.5	-1,879.96	249.6	-1,053.8	1,063.0	0.00	0.00	0.00
9,600.0	90.00	270.85	7,608.5	-1,879.96	251.1	-1,153.7	1,163.0	0.00	0.00	0.00
9,700.0	90.00	270.85	7,608.5	-1,879.96	252.6	-1,253.7	1,262.9	0.00	0.00	0.00
9,800.0	90.00	270.85	7,608.5	-1,879.96	254.0	-1,353.7	1,362.9	0.00	0.00	0.00
9,900.0	90.00	270.85	7,608.5	-1,879.96	255.5	-1,453.7	1,462.9	0.00	0.00	0.00
10,000.0	90.00	270.85	7,608.5	-1,879.96	257.0	-1,553.7	1,562.8	0.00	0.00	0.00
10,100.0	90.00	270.85	7,608.5	-1,879.96	258.5	-1,653.7	1,662.8	0.00	0.00	0.00
10,200.0	90.00	270.85	7,608.5	-1,879.96	260.0	-1,753.7	1,762.8	0.00	0.00	0.00
10,300.0	90.00	270.85	7,608.5	-1,879.96	261.4	-1,853.7	1,862.7	0.00	0.00	0.00
10,400.0	90.00	270.85	7,608.5	-1,879.96	262.9	-1,953.7	1,962.7	0.00	0.00	0.00
10,500.0	90.00	270.85	7,608.5	-1,879.96	264.4	-2,053.6	2,062.7	0.00	0.00	0.00
10,600.0	90.00	270.85	7,608.5	-1,879.96	265.9	-2,153.6	2,162.6	0.00	0.00	0.00
10,700.0	90.00	270.85	7,608.5	-1,879.96	267.4	-2,253.6	2,262.6	0.00	0.00	0.00
10,800.0	90.00	270.85	7,608.5	-1,879.96	268.8	-2,353.6	2,362.6	0.00	0.00	0.00
10,900.0	90.00	270.85	7,608.5	-1,879.96	270.3	-2,453.6	2,462.5	0.00	0.00	0.00
11,000.0	90.00	270.85	7,608.5	-1,879.96	271.8	-2,553.6	2,562.5	0.00	0.00	0.00
11,100.0	90.00	270.85	7,608.5	-1,879.96	273.3	-2,653.6	2,662.5	0.00	0.00	0.00
11,200.0	90.00	270.85	7,608.5	-1,879.96	274.8	-2,753.6	2,762.4	0.00	0.00	0.00
11,300.0	90.00	270.85	7,608.5	-1,879.96	276.2	-2,853.6	2,862.4	0.00	0.00	0.00
11,400.0	90.00	270.85	7,608.5	-1,879.96	277.7	-2,953.5	2,962.4	0.00	0.00	0.00
11,500.0	90.00	270.85	7,608.5	-1,879.96	279.2	-3,053.5	3,062.3	0.00	0.00	0.00
11,600.0	90.00	270.85	7,608.5	-1,879.96	280.7	-3,153.5	3,162.3	0.00	0.00	0.00
11,700.0	90.00	270.85	7,608.5	-1,879.96	282.2	-3,253.5	3,262.3	0.00	0.00	0.00
11,800.0	90.00	270.85	7,608.5	-1,879.96	283.6	-3,353.5	3,362.2	0.00	0.00	0.00
11,900.0	90.00	270.85	7,608.5	-1,879.96	285.1	-3,453.5	3,462.2	0.00	0.00	0.00
12,000.0	90.00	270.85	7,608.5	-1,879.97	286.6	-3,553.5	3,562.2	0.00	0.00	0.00
12,100.0	90.00	270.85	7,608.5	-1,879.97	288.1	-3,653.5	3,662.1	0.00	0.00	0.00
12,200.0	90.00	270.85	7,608.5	-1,879.97	289.6	-3,753.5	3,762.1	0.00	0.00	0.00

Planning Report



Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-5
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-5	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey										
MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
12,300.0	90.00	270.85	7,608.5	-1,879.97	291.0	-3,853.4	3,862.1	0.00	0.00	0.00
12,400.0	90.00	270.85	7,608.5	-1,879.97	292.5	-3,953.4	3,962.0	0.00	0.00	0.00
12,500.0	90.00	270.85	7,608.5	-1,879.97	294.0	-4,053.4	4,062.0	0.00	0.00	0.00
12,600.0	90.00	270.85	7,608.5	-1,879.97	295.5	-4,153.4	4,162.0	0.00	0.00	0.00
12,700.0	90.00	270.85	7,608.5	-1,879.97	297.0	-4,253.4	4,261.9	0.00	0.00	0.00
12,800.0	90.00	270.85	7,608.5	-1,879.97	298.4	-4,353.4	4,361.9	0.00	0.00	0.00
12,900.0	90.00	270.85	7,608.5	-1,879.97	299.9	-4,453.4	4,461.9	0.00	0.00	0.00
13,000.0	90.00	270.85	7,608.5	-1,879.97	301.4	-4,553.4	4,561.8	0.00	0.00	0.00
13,100.0	90.00	270.85	7,608.5	-1,879.97	302.9	-4,653.4	4,661.8	0.00	0.00	0.00
13,200.0	90.00	270.85	7,608.5	-1,879.97	304.3	-4,753.3	4,761.8	0.00	0.00	0.00
13,300.0	90.00	270.85	7,608.5	-1,879.97	305.8	-4,853.3	4,861.7	0.00	0.00	0.00
13,400.0	90.00	270.85	7,608.5	-1,879.97	307.3	-4,953.3	4,961.7	0.00	0.00	0.00
13,500.0	90.00	270.85	7,608.5	-1,879.97	308.8	-5,053.3	5,061.7	0.00	0.00	0.00
13,600.0	90.00	270.85	7,608.5	-1,879.97	310.3	-5,153.3	5,161.6	0.00	0.00	0.00
13,700.0	90.00	270.85	7,608.5	-1,879.97	311.7	-5,253.3	5,261.6	0.00	0.00	0.00
13,800.0	90.00	270.85	7,608.5	-1,879.97	313.2	-5,353.3	5,361.6	0.00	0.00	0.00
13,900.0	90.00	270.85	7,608.5	-1,879.97	314.7	-5,453.3	5,461.5	0.00	0.00	0.00
14,000.0	90.00	270.85	7,608.5	-1,879.97	316.2	-5,553.3	5,561.5	0.00	0.00	0.00
14,100.0	90.00	270.85	7,608.5	-1,879.98	317.6	-5,653.2	5,661.5	0.00	0.00	0.00
14,200.0	90.00	270.85	7,608.5	-1,879.98	319.1	-5,753.2	5,761.4	0.00	0.00	0.00
14,300.0	90.00	270.85	7,608.5	-1,879.98	320.6	-5,853.2	5,861.4	0.00	0.00	0.00
14,400.0	90.00	270.85	7,608.5	-1,879.98	322.1	-5,953.2	5,961.4	0.00	0.00	0.00
14,500.0	90.00	270.85	7,608.5	-1,879.98	323.5	-6,053.2	6,061.3	0.00	0.00	0.00
14,600.0	90.00	270.85	7,608.5	-1,879.98	325.0	-6,153.2	6,161.3	0.00	0.00	0.00
14,700.0	90.00	270.85	7,608.5	-1,879.98	326.5	-6,253.2	6,261.3	0.00	0.00	0.00
14,800.0	90.00	270.85	7,608.5	-1,879.98	328.0	-6,353.2	6,361.2	0.00	0.00	0.00
14,900.0	90.00	270.85	7,608.5	-1,879.98	329.5	-6,453.2	6,461.2	0.00	0.00	0.00
15,000.0	90.00	270.85	7,608.5	-1,879.98	330.9	-6,553.1	6,561.2	0.00	0.00	0.00
15,100.0	90.00	270.85	7,608.5	-1,879.98	332.4	-6,653.1	6,661.1	0.00	0.00	0.00
15,200.0	90.00	270.85	7,608.5	-1,879.98	333.9	-6,753.1	6,761.1	0.00	0.00	0.00
15,300.0	90.00	270.85	7,608.5	-1,879.98	335.4	-6,853.1	6,861.1	0.00	0.00	0.00
15,400.0	90.00	270.85	7,608.5	-1,879.98	336.8	-6,953.1	6,961.0	0.00	0.00	0.00
15,500.0	90.00	270.85	7,608.5	-1,879.98	338.3	-7,053.1	7,061.0	0.00	0.00	0.00
15,600.0	90.00	270.85	7,608.5	-1,879.98	339.8	-7,153.1	7,161.0	0.00	0.00	0.00
15,700.0	90.00	270.85	7,608.5	-1,879.99	341.3	-7,253.1	7,260.9	0.00	0.00	0.00
15,800.0	90.00	270.85	7,608.5	-1,879.99	342.7	-7,353.1	7,360.9	0.00	0.00	0.00
15,900.0	90.00	270.85	7,608.5	-1,879.99	344.2	-7,453.1	7,460.9	0.00	0.00	0.00
16,000.0	90.00	270.84	7,608.5	-1,879.99	345.7	-7,553.0	7,560.8	0.00	0.00	0.00
16,100.0	90.00	270.84	7,608.5	-1,879.99	347.2	-7,653.0	7,660.8	0.00	0.00	0.00
16,200.0	90.00	270.84	7,608.5	-1,879.99	348.6	-7,753.0	7,760.8	0.00	0.00	0.00
16,300.0	90.00	270.84	7,608.5	-1,879.99	350.1	-7,853.0	7,860.7	0.00	0.00	0.00
16,400.0	90.00	270.84	7,608.5	-1,879.99	351.6	-7,953.0	7,960.7	0.00	0.00	0.00
16,500.0	90.00	270.84	7,608.5	-1,879.99	353.1	-8,053.0	8,060.7	0.00	0.00	0.00
16,600.0	90.00	270.84	7,608.5	-1,879.99	354.5	-8,153.0	8,160.6	0.00	0.00	0.00
16,700.0	90.00	270.84	7,608.5	-1,879.99	356.0	-8,253.0	8,260.6	0.00	0.00	0.00
16,800.0	90.00	270.84	7,608.5	-1,879.99	357.5	-8,353.0	8,360.6	0.00	0.00	0.00
16,900.0	90.00	270.84	7,608.5	-1,879.99	359.0	-8,452.9	8,460.5	0.00	0.00	0.00
17,000.0	90.00	270.84	7,608.5	-1,880.00	360.4	-8,552.9	8,560.5	0.00	0.00	0.00
17,100.0	90.00	270.84	7,608.5	-1,880.00	361.9	-8,652.9	8,660.5	0.00	0.00	0.00
17,200.0	90.00	270.84	7,608.5	-1,880.00	363.4	-8,752.9	8,760.4	0.00	0.00	0.00
17,300.0	90.00	270.84	7,608.5	-1,880.00	364.8	-8,852.9	8,860.4	0.00	0.00	0.00
17,400.0	90.00	270.84	7,608.5	-1,880.00	366.3	-8,952.9	8,960.4	0.00	0.00	0.00
17,500.0	90.00	270.84	7,608.5	-1,880.00	367.8	-9,052.9	9,060.3	0.00	0.00	0.00
BHL: 1620ft FNL & 460ft FWL of Sec 21										

Database:	EDM 5000.1 Single User Db	Local Co-ordinate Reference:	Well HOULIHAN 4-64 22A 21-5
Company:	BISON EXPLORATION	TVD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Project:	ARAPAHOE COUNTY, COLORADO (NAD 83)	MD Reference:	KB-EST @ 5728.5usft (Original Well Elev)
Site:	SE NE SEC. 22 T4S R64W 6th P.M.	North Reference:	True
Well:	HOULIHAN 4-64 22A 21-5	Survey Calculation Method:	Minimum Curvature
Wellbore:	ORIGINAL WELLBORE		
Design:	PROPOSAL #1		

Planned Survey

MD (usft)	Inc (°)	Azi (°)	TVD (usft)	SS (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
17,519.0	90.00	270.84	7,608.5	-1,880.00	368.1	-9,071.9	9,079.4	0.00	0.00	0.00

Formations

MD (usft)	TVD (usft)	Name	Lithology	Dip (°)	Dip Direction (°)
315.5	315.5	DENVER			
801.1	800.5	UPPER ARAPAHOE			
1,094.8	1,090.5	LOWER ARAPAHOE			
1,661.1	1,644.5	LARAMIE - FOX HILLS			
1,867.7	1,846.5	PIERRE SHALE (BASE FOX HILLS			
5,355.9	5,258.5	SHANNON SANDSTONE MBR			
7,438.6	7,323.5	SHARON SPRINGS SHALE			
7,504.6	7,378.5	NIOBRARA FORMATION			
7,517.2	7,388.5	NIOBRARA A CHALK			
7,693.3	7,508.5	NIOBRARA B CHALK			
7,885.2	7,588.5	NIOBRARA C CHALK			

Plan Annotations

MD (usft)	TVD (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
0.0	0.0	0.0	0.0	SHL: 1854ft FNL & 1005ft FEL of Sec 22
500.0	500.0	0.0	0.0	START NUDGE (2°/100ft BUR)
1,100.1	1,095.8	13.7	61.1	EOB TO 12° INC
5,336.7	5,239.7	205.7	921.0	END OF TANGENT
5,936.9	5,835.5	219.4	982.1	EOD TO VERTICAL
7,136.9	7,035.5	219.4	982.1	KOP (10°/100ft BUR)
7,897.6	7,591.6	225.9	547.1	BEGIN PROD INTERVAL
8,036.9	7,608.5	227.9	409.2	HZ LP *NEW*: 1620ft FNL & 597.9ft FEL of Sec 22
17,519.0	7,608.5	368.1	-9,071.9	BHL: 1620ft FNL & 460ft FWL of Sec 21